"LEFT VENTRICULAR DYSFUNCTION IN PREECLAMPTIC PATIENTS"

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IN

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MADRAS MEDICAL COLLEGE AND

RESEARCH INSTITUTE.

MAY 2018

BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled "**LEFT VENTRICULAR DYSFUNCTION IN PREECLAMPTIC PATIENTS"** isthe bonafide work done by **Dr.K.M KUNGUMA SANGETA**, post graduate in the Department of Obstetrics and Gynaecology, Institute of Obstetrics and Gynaecology, Government Women and Children Hospital, Madras Medical College, Chennai, towards partial fulfillment of the requirements of The Tamil Nadu Dr.M.G.R University for the award of M.S Degree in Obstetrics and Gynaecology.

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DECLARATION

I, Dr.K.M.KUNGUMA SANGETA, solemnly declare that the dissertation titled, "**LEFT VENTRICULAR DYSFUNCTION IN PREECLAMPTIC PATIENTS"** has been done by me. I also declare that this bonafide work or part of this work was not submitted by me for any award, degree, diploma to any other university either in India or abroad.

This is submitted to The Tamil Nadu Dr. MGR medical University, Chennai in partial fulfillment of the rules and regulations for the award of M.S Degree (Obstetrics and Gynaecology) held in May 2018.

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Date:

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CONTENTS

ABBREVIATIONS

BMI	body mass index
BP	blood pressure
CI	cardiac index
CO	cardiac output
CVD	cardiovascular disease
DBP	diastolic blood pressure
DT	deceleration time
Ea	arterial elastance
ECG	electrocardiogram
EF	ejection fraction
FS	fractional shortening
LV	left ventricle
LVEDV	left ventricular end-diastolic volume
LVEF	left ventricular ejection fraction
LVESV	left ventricular end-systolic volume

LVET	left ventricular ejection time
IVSd	inter ventricular septal wall dimension in diastole
NP	normal pregnancy
PE	preeclampsia/preeclamptic
SBP	systolic blood pressure
SV	stroke volume

INTRODUCTION

Pregnancy is the physiological change which causes dramatic and reversible changes in a women cardiovascular system and hemodynamic variables which require necessary adaptations in order to develop fetus normally. When this adaptation fails, the consequences like preeclampsia and other hypertensive disorder results which affects the fetus growth and delivery

Pregnancy is adapted by increase in blood volume and plasma volume which leads to increase in cardiac output (CO) affected by remodeling of heart similar to that observed in athletes with increase in chamber dimensions and LV wall thickness and mass. Normal pregnancy also results in decrease in systemic vascular resistance and decline in blood pressure

Preeclampsia is one of the most common and potentially life threatening complications of pregnancy. It is a multiorgan syndrome that affects 8% to 10 % of pregnancy and its the leading cause for maternal mortality and morbidity and it is the leading cause of preterm delivery . It is a unique condition of placental pathogenesis with acute onset of predominantly cardiovascular changes and dysfunction attributable to generalized vascular endothelial activation and vaso-spasm resulting in hypertension and multi-organ syndrome.

Various cross sectional studies on pre eclamptic women showed diverse hemodynamic changes that includes reduced CO due to reduced myocardial contractility and in some cases, elevated CO and high vascular resistance in early pregnancy , which is much exaggerted during latent stage of pregnancy.

Various societies provide different criteria for the diagnosis of preeclampsia. Common to all diagnostic criteria is that preeclampsia is a syndrome characterized by new-onset hypertension (≥140 mm Hg systolic blood pressure [SBP] or ≥90 mm Hg diastolic blood pressure [DBP]) on two occasions at least 4 hours apart arising after 20 weeks of gestation with proteinuria ≥300 mg per 24 hour urine collection with >1 organ system involvement and complete resolution within 12 weeks postpartum. Although not distinct entities, it is increasingly becoming apparent that early-onset preeclampsia is especially associated with poor placentation, fetal growth restriction, and worse long-term maternal cardiovascular outcomes than late-onset preeclampsia, whose pathogenesis is more related to predisposing cardiovascular or metabolic risks for endothelial dysfunction. Furthermore, because the pathogenesis of preeclampsia has not been fully elucidated, the search for predictive markers and a preventative strategy remains an unfulfilled goal. Hence, clinical management is mainly symptomatic and directed to prevent maternal morbidity and mortality.

Advancement in technology in the field of medicine like transthoracic echocardiography is the reference standard investigation for cardiovascular system diagnosis, monitoring and research purposes. It is a valid, precise and reproducible measurement device in research studies providing information not only about cardiac output, which the perioperative literature is currently focusing on, but also on other measurements of systolic function, and diastolic, structural and functional information of heart

AIM AND OBJECTIVES OF THE STUDY

To study the cardiac function in preeclamptic patients by transthoracic echocardiography and compare these features with normal pregnant patients, belonging to third trimester.

REVIEW OF LITERATURE

1. Classification of hypertensive disorders in pregnancy

There were various classifications for hypertensive disorders in pregnancy based on diagnostic criteria (WHO, 1987; Davey and MacGillivary, 1988; Helewa *etal.,* 1997; Brown *et al.,* 2000; NHBPEP, 2000). The widely accepted classificationpresently is International Society for the Study of Hypertension in Pregnancy (ISSHP) (Brown *et al.,* 2001). According to ISSHP , Brown et al.,2001 ,classified as

(1) Pre-eclampsia

(2) Chronic hypertension – essential or secondary

(3) Pre-eclampsia superimposed on chronic hypertension

(4)Gestational/pregnancy induced hypertension.

The term gestational hypertension was adopted by working group of NHBPEP (2000) to replace pregnancy induced hypertension (Brown and de Swiet, 1999; Leeman and Fontaine, 2008).

ECHOCARDIOGRAPHY IN PREGNANCY

An **echocardiogram**, often referred to as a **cardiac echo** is a non invasive imaging techniqueof the heart. Echocardiography uses standard two-dimensional, three-dimensional, and Doppler ultrasound to create images of the heart which evaluate structural,functional and hemodynamic status of cardiovascular system

Echocardiography has become routinely used in the diagnosis, management, and follow-up of patients with any suspected or known heart disease during pregnancy like congenital heart diseases ,valvular heart diseases and hypertensive disorders and also other complications of pregnancy on heart. It can provide a wealth of helpful information, including the size and shape of the heart (internal chamber size quantification), pumping capacity, and the location and extent of any tissue damage after any injury to heart. An echocardiogram can also give physicians other estimates of heart function, such as a calculation of the cardiac output, ejection fraction, systolic and diastolic function and dysfunction during pregnancy Echocardiography can help detect cardiomyopathies, such as hypertrophic cardiomyopathy, dilated cardiomyopathy, and peripartum cardiomyopathy during pregnancy. The use of stress echocardiography may also help determine whether any chest pain or associated symptoms are related to heart disease.

It can also produce accurate assessment of the blood flowing through the heart by Doppler echocardiography, using pulsed- or continuous-wave Doppler ultrasound. This allows assessment of both normal and abnormal blood flow through the heart. Color Doppler, as well as spectral Doppler, is used to visualize any abnormal communications between the left and right sides of the heart, any leaking of blood through the valves (valvular regurgitation), and estimate how well the valves open (or do not open in the case of valvular stenosis). The Doppler technique can also be used for tissue motion and velocity measurement, by tissue Doppler echocardiography.

Echocardiography with Doppler readily assesses LV systolic and diastolic function; advantages include that echocardiography is non-invasive, does not require radiation, is portable, rapid, readily available, and in competent hands, can provide an accurate and comprehensive assessment of LV systolic and diastolic function of heart in pregnancy and other cardio vascular disorders of the heart like preeclampsia . Correct assessment of LV diastolic function is relevant in patients with both depressed and preserved LV ejection fraction (EF <50%, and >50%, respectively). Tissue Doppler (TD) imaging has been useful in demonstrating impaired LV relaxation in the setting of preserved LVEF, which, in the setting of increased cardiac volume, can result in elevated LV filling pressures, and dyspnea due to diastolic heart failure. Tissue doppler imaging is not always critical in patients with depressed LVEF,

since such patients by definition have impaired LV relaxation, and thus significant increases in volume will result in increases in LV filling pressure due to impaired LV compliance. Thus, in depressed LVEF, transmitral flow velocities (E and A, and E/A) and deceleration time, pulmonary venous Doppler, left atrial volume, and pulmonary artery (PA) pressures suffice for the accurate assessment of LV filling pressures. Overall, diastolic assessment by echo-Doppler can be readily achieved in by using a comprehensive diastolic assessment—incorporating many 2-dimensional, conventional and tissue Doppler variables—as opposed to relying on any single, diastolic parameter, which can lead to errors.

Three parameters are most frequently used to define LV systolic function of heart

1. cardiac output

2. Ejection fraction

3. Fractional shortening

Ejection fraction of heart is defined as percentage of end diastolic volume blood ejected out of heart during each beat of heart.

EF = EDV-ESV/ EDV x 100

Where EDV - End diastolic volume

ESV - End systolic volume

Normal range - 50 to 75 %

Fractional shortening is a percent change in LV dimension with systolic contraction and is calculated from the formula

FS = LVEDD - LVESD / LVEDD * 100

Where LVEDD- Left ventricular end diastolic dimension

LVESD - Left ventricular end systolic dimension

The normal range is 25 to 46 %

LV diastolic function is evaluated using two parameters

1. E/A velocity

2. IVRT - Iso volumetric relaxation time

Primary measurements of transmitral inflow include the peak early filling (E wave) and late diastolic filling (A wave) velocities, the E/A ratio, and deceleration time (DT) of the E wave Secondary measurements include mitral A-wave duration and isovolumetric relaxation time (IVRT), derived using CWD of the left ventricular outflow tract (LVOT) to measure the interval between the end of aortic ejection and the onset of mitral inflow.

The E wave represents the LA pressure in early diastole and it occurs immediately following the IVRT and mitral valve opening. The deceleration time DT of the E wave is affected by the rate of rise in LV diastolic pressure as a result of early filling. In settings of restrictive diastolic dysfunction, athlete's heart, and pericardial constraint, the early filling shows rapid cessation of flow due either to rapidly rising pressure in the LV or rapid emptying of the LA into a highly compliant LV. The A-wave velocity is affected by LA pressure and LV compliance at the end of diastole. In stiff ventricles, the A wave is smaller and also of shorter duration.

Age is a important consideration when defining normal values of mitral inflow velocities and time intervals. With increase in age , the mitral E velocity and E/A ratio decreases, whereas DT and A velocity increases. A number of variables other than LV diastolic function and filling pressures affect mitral inflow, including heart rate and rhythm, PR interval, cardiac output, mitral annular size, and LA function. Age-related changes in diastolic function parameters may represent a slowing of myocardial relaxation, which predisposes older individuals to the development of diastolic heart failure.

Transmitral flow patterns have a U-shaped relation with LV diastolic function, with similar values seen in healthy normal subjects and patients with cardiac disease. Mechanical ventilation also alters

loading conditions and can affect flow patterns. Even in healthy subjects, clinical scenarios such as hypovolemia or volume overload can mimic pathologic patterns of mitral inflow.

Normal E/A ratio is 0.8 to 2.

IVRT normal value 73 to 110 msec

According to katz& co workers 1978, during pregnancy both left ventricular mass and end diastolic dimension increases akin to the increase in heart rate , stroke volume and cardiac output and studied about the adaptation of heart to pregnancy.

According to Geva T et al 1997, left ventricular volume increases 10.5 % paralleling the change in stroke volume .Thus the increase in volume and pressure load during normal pregnancy is associated with preservation of global pump function.

Borghi C.et al 2000 studied compared left ventricular structure and function among the preeclamptic patients with normal normotensive patients . Results shows that significant increase in left ventricular mass and left ventricular end systolic and end diastolic volumes and reduction in ejection fraction and fractional shortening with preeclamptic patients.

Bosio PM., 1999 did a study on hemodynamic variables during preclinical and clinical phases of non proteinuric gestational hypertension and preeclampsia using doppler echocardiography.

Desai DK et al 1996., reported that , left ventricular diastolic filling abnormalities with preserved systolic function compared to normotensive controls. This diastolic dysfunction plays a major role in development of pulmonary edema.

Thomson et al 1986 , shows that LV mass using echo in pregnant chronic hypertensive patients and preeclamptic patients. There is significant increase in LV mass in chronic hypertensive group than preeclamptic group.

Cardiac function in healthy pregnancy

Cardiovascular system changes that occur during pregnancy can be broadly divided into the four categories:

1. The effects of circulating hormones

2. Mechanical pressure due to the enlarging uteroplacental fetal unit

3. Increasing metabolic demands of the uteroplacental fetal unit

4.The presence of the uteroplacental circulation.

Manycardiac murmurs, mitral regurgitation and tricuspid regurgitation and small pericardial effusions have been reported in pregnancy and are asymptomatic.

Many Studies have been designed and tried to attempt to answer the two fundamental questions . what are the normal cardiovascular system changes that occur in pregnancy and the other what is their longitudinal relationship to the developing fetus and gestation.

Non-invasive assessments of cardiac output during pregnancy using transthoracic (Doppler) echocardiography have been studied previously. Transthoracic echocardiography is a preferred technique due to its relative ease of use, high quality and range of data. and its safety profile and accuracy (Augoustides, Hosalkar *et al.* 2005; Ferguson, Paech

et al. 2006;) Doppler echocardiography has been found to be an acceptable measurement of cardiac output in pregnancy (Easterling, Carlson *et al.* 1990)

Increase in normal cardiac output in healthy term pregnant women is approximately 5 l/min to 8 l/min with the peak of cardiac output being achieved at 28 to 30 weeks

Few studies report a decrease in cardiac output from second trimester (Atkins, Watt *et al.* 1981; Chestnut 2004). There is general statement that cardiac output increases during early pregnancy, however the precise mechanism is controversial. Increase in cardiac output in second trimester compared with first and third trimester, mainly due to an increase in heart rate which increases shortly after conception. This is thought to be mediated by the corpus luteum and is related to increasing levels of estrogens or vasodilatory peptides and factors such as calcitonin-gene-related peptide and nitric oxide. They also observed changes in blood pressure, blood volume and systemic vascular resistance. Some studies also have reported a reduction in both systolic and diastolic function near term. Systolic function, as measured by the septal Doppler indices of the septal s' velocity was significantly reduced to 6.7 cm/s compared with early pregnancy values.From the observations, normal pregnancy at term is associated with a mild impairment of systolic and diastolic function (Mone, Sanders *et al.* 1996)

Despite an increase in cardiac output during pregnancy, blood pressure is not increased. This is due to a reduction in systemic vascular resistance during pregnancy. This reduction is attributable to blood flow through the low resistance region of the uterine intervillous space acting in a similar to shunt. There is also receptor down regulation of the □ and □ adrenoceptors, in pregnancy and that prostacyclin release mediates the increase in regional blood flow. There is a debate about the effects of the sympathetic nervous system and the parasympathetic nervous system in pregnancy (Hughes, Levinson *et al.* 2002), however most studies investigating the sympathetic nervous system reports the increase in heart rate

CVS Changes During Pregnancy

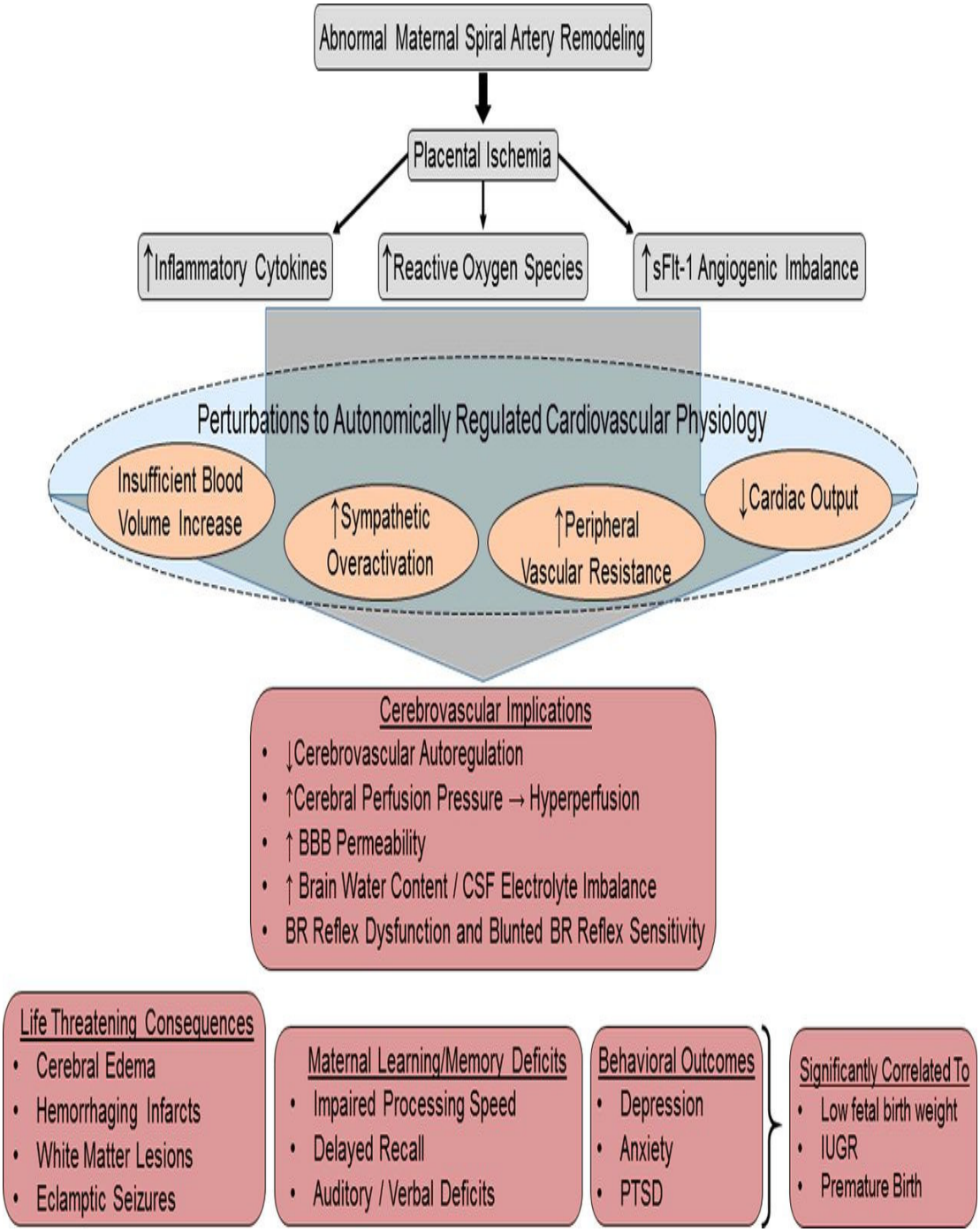
PARAMETER	DIRECTION	TIME COURSE
Heart rate	↑	1st and 2nd trimester (TM)
Blood pressure	↓	Fall in TM 1 and 2, returns to baseline in 3
Cardiac output	↑	45% above baseline by TM 3
Stroke Volume	↑	Peak at weeks 16 to 24
Systemic vascular resistance	↓	Nadir by mid pregnancy
Pulmonary vascular resistance	↓	20- 30% decrease

Cardiovascular system in women with preeclampsia

From the previous studies , it is clear that there is a paucity of knowledge about systolic and diastolic function in healthy pregnant women and many transthoracic echocardiography parameters are still to be quantified and valued. It is however vitally important to understand both the healthy pregnant women and the women with preeclampsia with respect to their cardiovascular system function as many interventions are used in the management preeclampsia have consequences either directly or indirectly with regard to the cardiovascular system.

Many different interventions and pharmacological drugs are used to manage women with preeclampsia. Currentknowledge relates only to historical use of drugs and perceived effects without actually measuring with modern equipment the effect on the cardiovascular system. In specific, it is not known whether these drugs and interventions will cause changes in systemic vascular resistance (SVR) or cardiac output from a baseline.Understanding the cardiovascular changes like cardiac output and systemic vascular resistance in women with untreated preeclampsia is a must. The use of intravenous fluids is a diversity of opinion regarding the appropriateness of intravenous fluids and amount to be transfused. There is debate about the preference of one form of antihypertensive agent over another, and the cardiovascular effects of magnesium

sulphate. There are many cardiovascular system complications of preeclampsia and many complications are due to therapeutic interventions, while treating preeclampsia. The basic principle in the management of women with preeclampsia is to maximize the beneficial interventions whilst minimizing complications related to the disease and the therapies. Inappropriate intravenous therapies and IV fluids can lead to the iatrogenic complication of acute pulmonary edema. A reduction in uterine artery blood flow compromising the fetus can occur with antihypertensive medications and interventions. Systolic cardiac failure and pulmonary edema can occur in some women with severe preeclampsia. It is therefore vital to define the native disease state in women with untreated preeclampsia in order to better manage therapeutic interventions.


Abnormal Maternal Spiral Artery Remodeling
Placental Ischemia
↑Inflammatory Cytokines
↑Reactive Oxygen Species
↑sFlt-1 Angiogenic Imbalance
Perturbations to Autonomically Regulated Cardiovascular Physiology
Insufficient Blood Volume Increase
↑Sympathetic Overactivation
↑Peripheral Vascular Resistance
↓Cardiac Output
Cerebrovascular Implications
• ↓Cerebrovascular Autoregulation
• ↑Cerebral Perfusion Pressure → Hyperperfusion
• ↑ BBB Permeability
• ↑ Brain Water Content / CSF Electrolyte Imbalance
• BR Reflex Dysfunction and Blunted BR Reflex Sensitivity
Life Threatening Consequences
• Cerebral Edema
• Hemorrhaging Infarcts
• White Matter Lesions
• Eclamptic Seizures
Maternal Learning/Memory Deficits
• Impaired Processing Speed
• Delayed Recall
• Auditory / Verbal Deficits
Behavioral Outcomes
• Depression
• Anxiety
• PTSD
Significantly Correlated To
• Low fetal birth weight
• IUGR
• Premature Birth

SUBJECTS AND METHODS

This study was conducted in Govt Institute of Obstetrics and Gynecology Hospital Egmore over a period of 1 year from sept.2016 to sept.2017. This study has assigned and categorized into two groups .

Group I

Normotensive pregnant patients - 40 cases, between age group of 18 to 32 years .

INCLUSION CRITERIA:

Pregnant women with normal blood pressure.

Pregnant women in gestational age 28 to 40 weeks as calculated by LMP and dating scan.

No previous h/o preeclampsia or essential hypertension

Not on treatment for any medical or surgical illness

EXCLUSION CRITERIA:

Previous history of hypertension

Recurrent gestational hypertension/PIH

Patients with medical disorders of pregnancy

Group 2

Pregnant preeclamptic patients 40 cases, between age group of 18 to 32 years .

INCLUSION CRITERIA:

Pregnant patients with systolic BP >/=140mm Hg and diastolic BP>/=90mm Hg that develops after 20 weeks of gestation confirmed by repeated examination of atleast 6 hours apart with proteinuria of trace to 2+ or spot PCR >0.3

Pregnant women in gestational age 28 to 40 weeks as calculated by LMP and dating scan.

No previous H/O essential hypertension

No other medical disorders complicating this pregnancy

EXCLUSION CRITERIA

Previous history of hypertension

Recurrent gestational hypertension/PIH

Patients with medical disorders of pregnancy

STUDY DESIGN AND METHODS

This is prospective controlled study consisting of two groups of patientsie., 40 normotensive pregnancy women and 40 preeclamptic patients. Both these groups of patients underwent echocardiography in third trimester to study the left ventricular function by using several parameters . This study also correlated mode of delivery and gestational age at the delivery and birth weight of fetus .

STUDY PROTOCOL

- Clinical history was recorded in detail about all patients.
- Blood pressure was measured using conventional sphygmomanometer, patient in sitting position , with the arm at the level of heart. Systolic bp and diastolic BP was measured using Korotkoffs sound .
- Obstetric examination was performed and
- ultra sonogram was performed for all patients and all the details are documented in two groups.
- Urine spot PCR for proteinuria was measured in two groups .
- ECG and other relevant blood investigations are performed in two groups.
- Echocardiography was done in all patients at third trimester.

ECHOCARDIOGRAPHIC STUDIES

Echocardiography was performed in all patients in a left lateral recumbent position with 15 minutes undisturbed before echo. Echocardiography was performed using MEGAS CVX and MEGAS GPX equipped with Philips HD7 echocardiograph machinein the parasternal and apical windows.Two dimensional doppler echocardiography also performed using 3.5 MHz probe . M-mode studies were performed at the level of aorta,left atrium and LV at mid position between the tips of the mitral valve and papillary muscles. We recorded conventional grey scale cineloops, pulsed and continuous wave Doppler recordings of blood flow velocities, and tissue-Doppler cineloops of LV.

The parameters measured were

1.Systolic function

A.Left ventricular end-diastolic diameter (LVEDD)

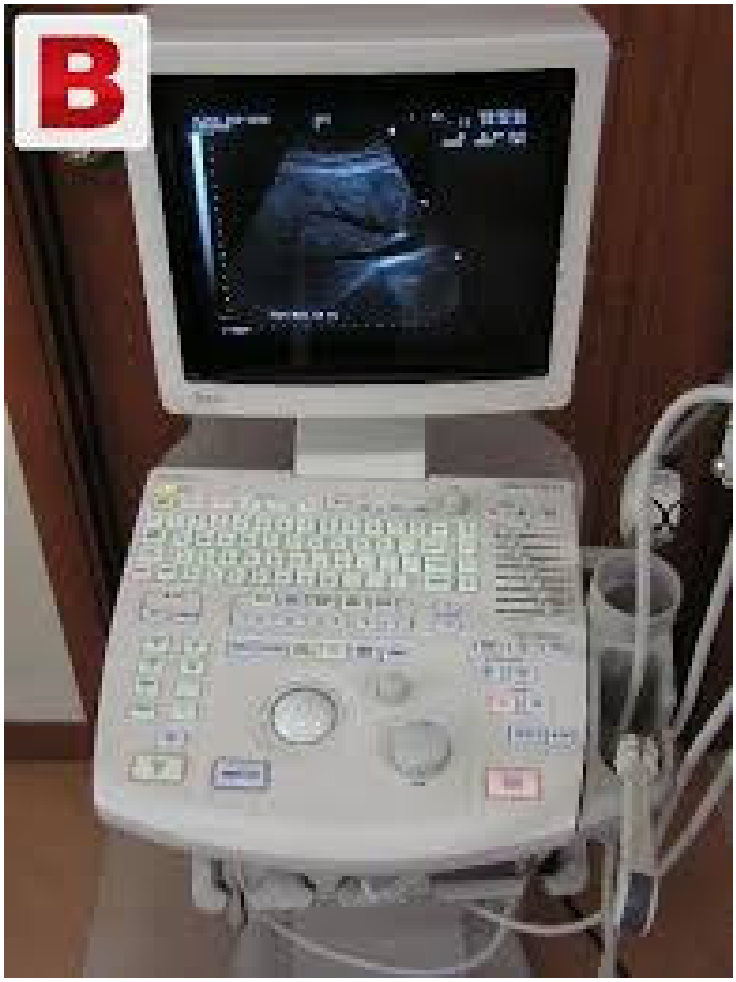
B. Left ventricularend-systolic diameter (LVESD)

C. Left ventricular posterior wall thickness in systole (LVPWs)

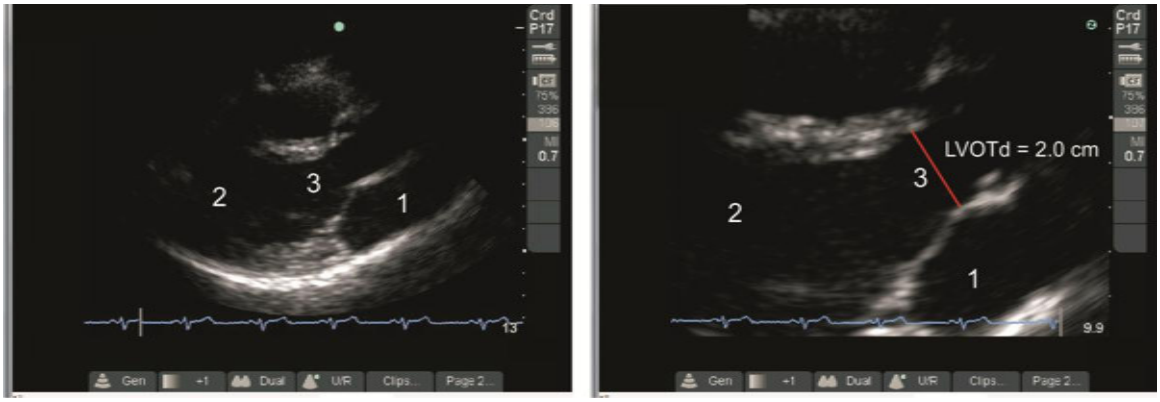
D.Left ventricular posterior wall thickness in diastole (LVPWd)

E.Ejection fraction (EF) were calculated by use of the Simpson's modified biplane method utilizing endocardial contours in the apical 4 and 2 chamber view

F.Fractional shortening (FS %)



Figure; Parasternal long axis view in a healthy pregnant woman - Cardiac model and probe position The image on the left shows the left atrium (1), mitral valve, left ventricle (2), left ventricular outflow tract (3)and aortic valve in a model of the heart (the parasternal long axis image). The image on the right shows the position of the cardiac probe (transducer) on the chest to acquire the parasternal long axis image. Note the index maker (red dot) on the probe is directed towards the right shoulder tip and the probe is held softly and perpendicular to the chest.



Figure; Parasternal long axis image in a healthy pregnant woman – Transthoracic echocardiography images

The image on the right is the frozen image of the left ventricular outflow tract (3) during systole with the red line showing the left ventricular outflow tract measurement. The left ventricular outflow tract diameter is 2.0 cm.

1 = left atrium; 2 = left ventricle; 3 = left ventricular outflow tract

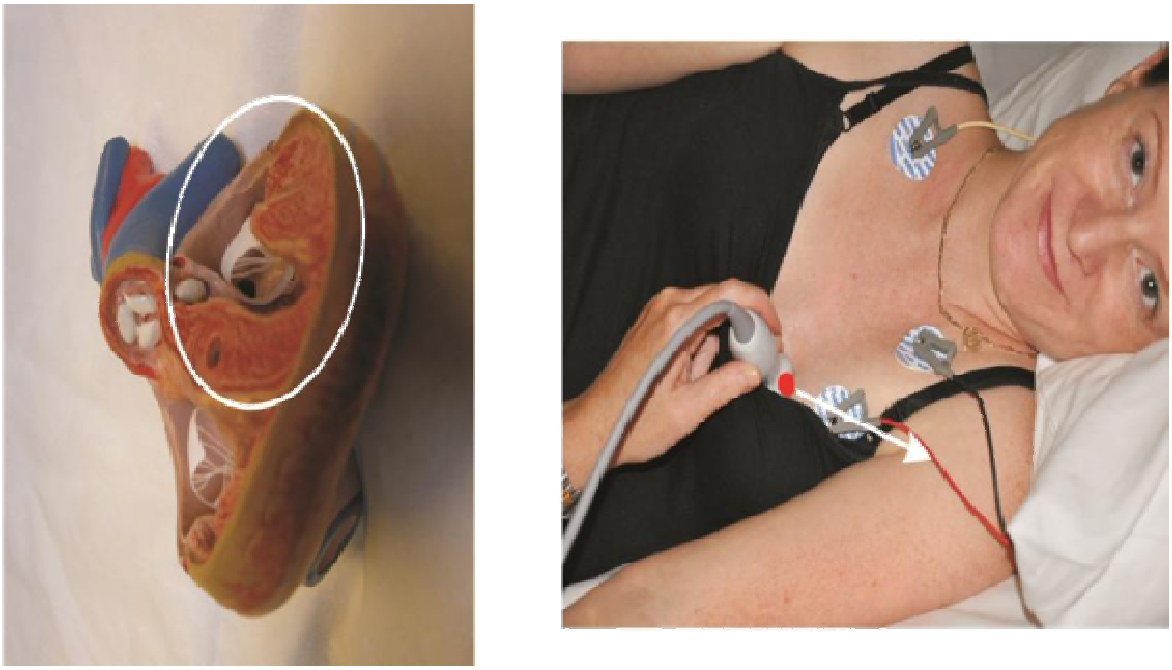
Fractional shortening

Fractional shortening is well correlated with angiographically determined ejection fraction. The reference range is 27 - 45% for non-pregnant females. The cursor was placed perpendicular to the long or short axis of the left ventricle just distal to the tips of the open mitral valve leaflets. Left ventricular end diastolic diameter (LVEDD) measurements were made at the onset of QRS complex inner edge to inner edge and the average of three measurements was taken. Left

ventricular end systolic (LVESD) measurements were made at the point marking the peak posterior deflection of the interventricular septum inner edge to inner edge and the average of three measurements were taken.

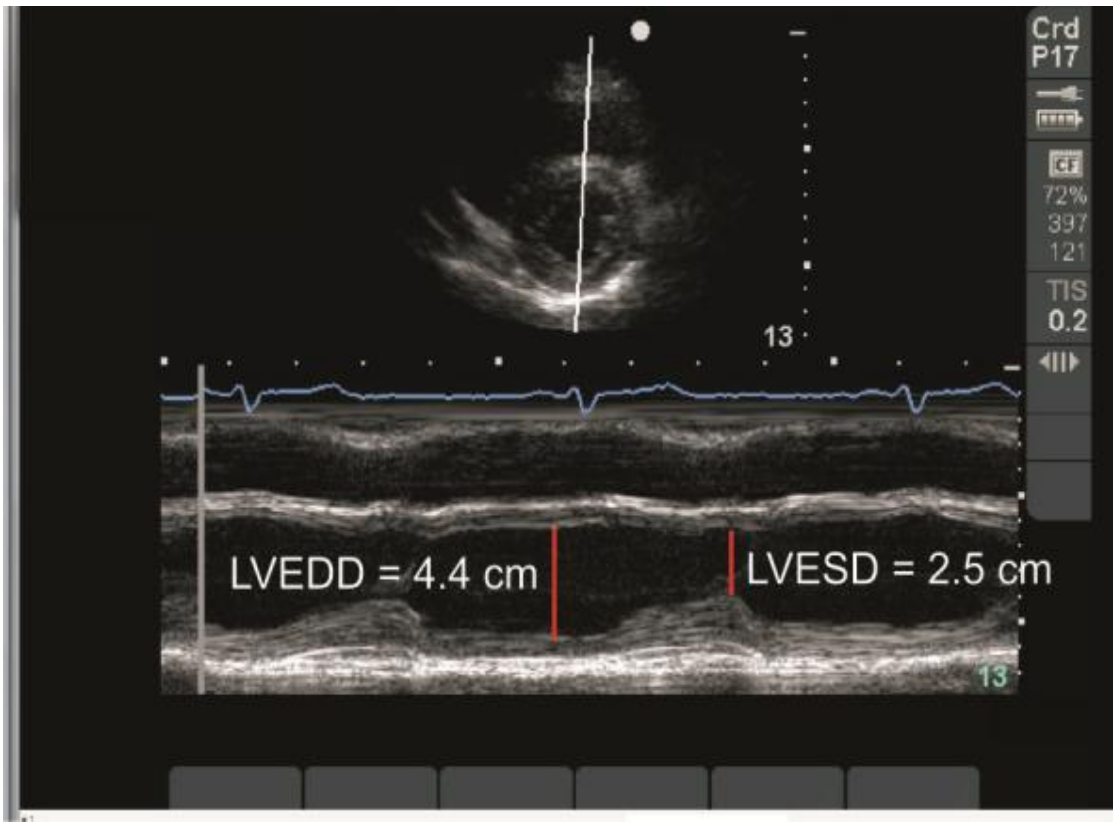
Fractional shortening (FS) (%) = (LVEDD – LVESD)/LVEDD □ 100.

Left ventricular end diastolic diameter has the reference range of 3.9 – 5.3 cm .



Figure; Parasternal short axis view in a healthy pregnant woman – Cardiac model and probe position

The image on the left shows the short axis of the left ventricle with the right ventricle at the lower part of the picture (the parasternal short axis image). The image on the right shows the position of the cardiac probe on the chest to acquire the parasternal short axis image. Note the index maker (red dot) on the probe is directed towards the left shoulder tip and the probe is held softly and perpendicular to the chest.



Figure; Parasternal short axis image in a healthy pregnant woman – Transthoracic echocardiography M-mode mid-papillary region left ventricle – Fractional shortening

The image shows the left ventricular end diastolic diameter (red line) (4.4 cm), the left ventricular end systolic diameter (red line) (2.5 cm). Fractional shortening [(LVEDD-LVESD)/LVEDD] □ 100 = 43%

2.DIASTOLIC FUNCTION

Pulsed Doppler blood flow velocities were recorded at the mitral valve ring and tip, and in the LV outflow tract.

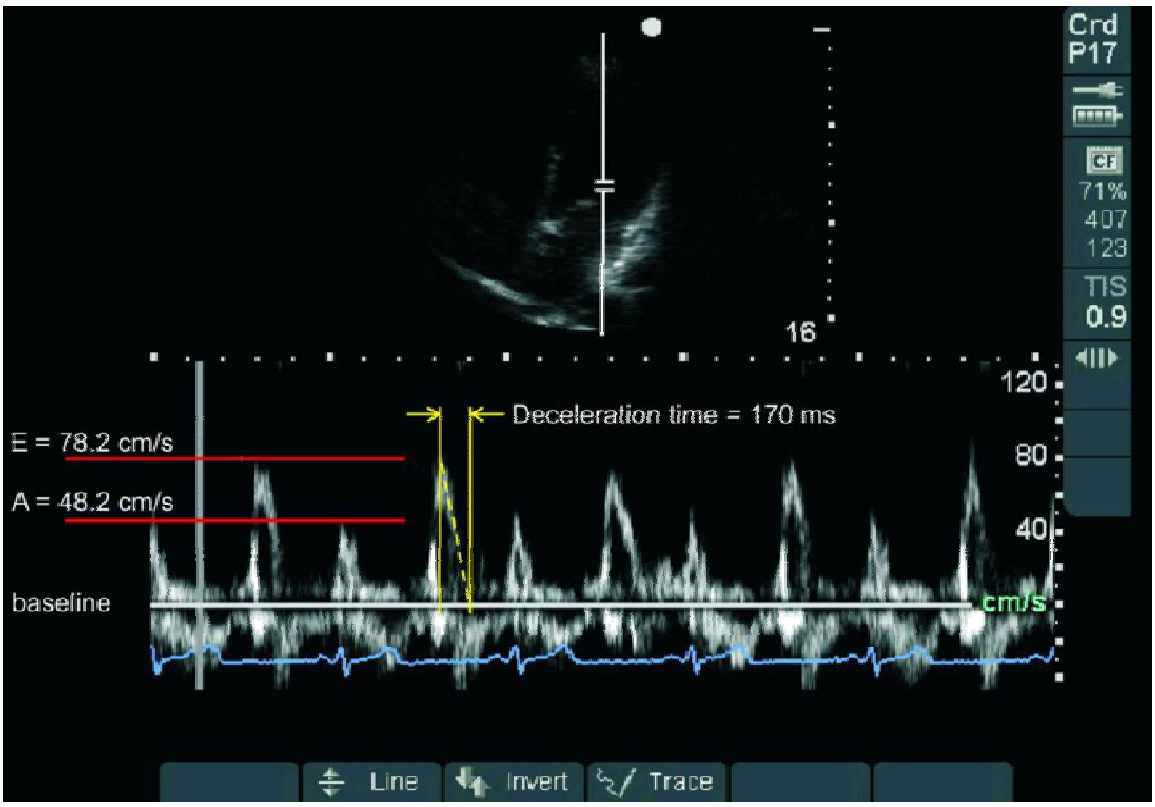
A.Mitral peak early (E) diastolic flow velocity

B. Mitral peak late (A) diastolic flow velocity

C. E to A ratio (E/A RATIO)

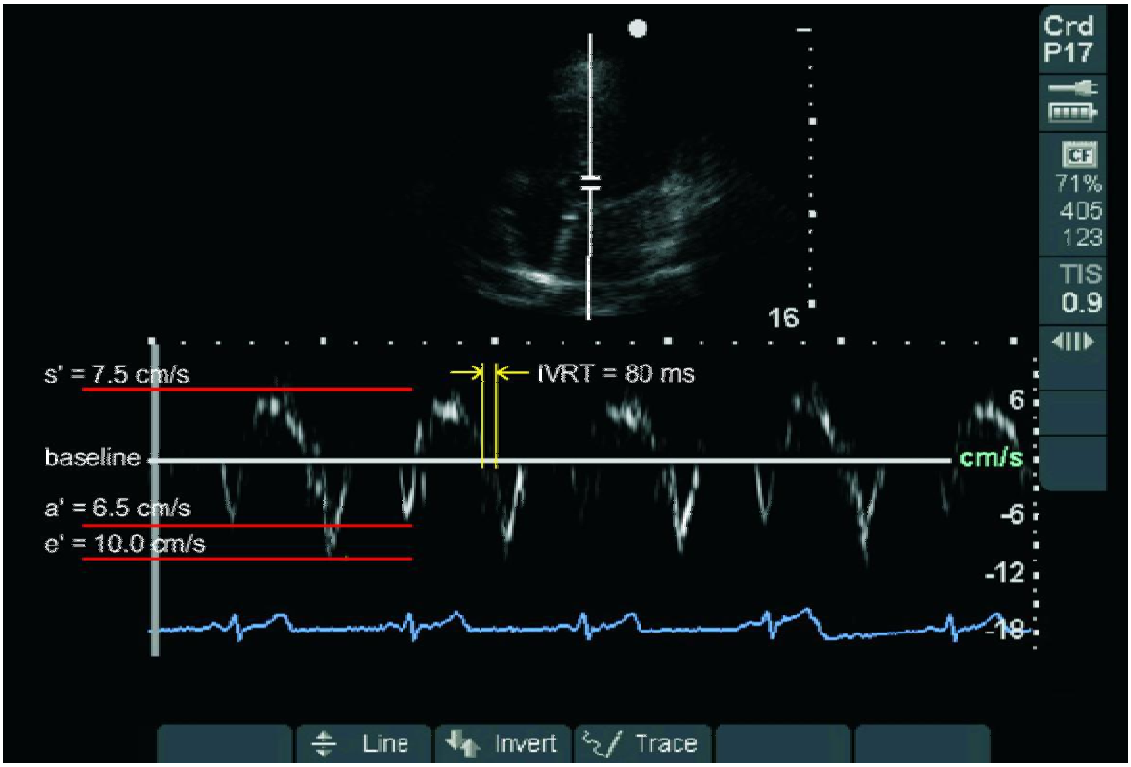
D. E deceleration time

Pulsed Tissue Doppler recordings were obtained using a predefined 9 mm sample volume positioned at the septal and the lateral aspects of basal LV at the junction with the mitral annulus in the apical 4-chamber view (Figure shown below)



Figure;Apical 4 chamber view in a healthy pregnant woman – Mitral valve inflow Doppler waveform

The mitral valve E wave is 78.2 cm/s. The mitral valve A wave is 48.2 cm/s. Therefore mitral valve E/A ratio = 1.6. The mitral valve deceleration time is 170 ms. Velocities are shown as positive deflections as flow is towards the transducer during diastole.



Figure; Apical 4 chamber view in a healthy pregnant woman – Septal tissue Doppler waveform

This is the appearance of the septal tissue Doppler waveform in a healthy pregnant woman. The waveform consists of three main deflections. The first deflection above the baseline (0 cm/s line) that occurs during systole is the s□ wave. The peak velocity is recorded as the s□ velocity. In this case the s□ velocity is 7.5 cm/s. The first deflection below the baseline in diastole is the e□ wave. The peak velocity of this wave is recorded as the e□ velocity. In this example it is 10.0 cm/s. The time period between the end of the s□ wave and the beginning of the e□

wave is known as the isovolumetric relaxation time (IVRT). In this example it is 80 ms. The second downward deflection during diastole is the a□ wave. The peak deflection is recorded as the a□ velocity and in this case it is 6.5 cm/s. Therefore the septal e□/septal a□ ratio is 1.5. The mitral valve E/septal e□ = 7.8.

Statistical methods

Clinicalhistory,blood examination, urine test and echocardiography at the third trimester and mode of delivery and gestational age at delivery was obtained from a sample size of 40 healthy pregnant women and 40 women with preeclampsia diagnosed in our hospital. Therefore 40 women with untreated preeclampsia were gestationally matched with 40 healthy pregnant women in this study. These data was compared and appropriate statistical analysis was made.

Two groups

1.Healthy pregnant women (HP) gestationally matched to

2.women with preeclampsia diagnosed.

In this study data were shown as mean ± standard deviation (SD). Analysis of variance (ANOVA) was used to compare data between normotensive pregnant and preeclamptic groups. Student's *t*-test was used as a test of significance. The probability value ($P< 0.05$) is described as significant.Analyses were performed using SSPS version 7.7.

OBSERVATION AND RESULTS:

A total of 80 subjects were recruited to the study divided into two groups Group I served as normal subjects and Group II preeclamptic 30 subjects in each group. There were no statisitcal difference in groups.

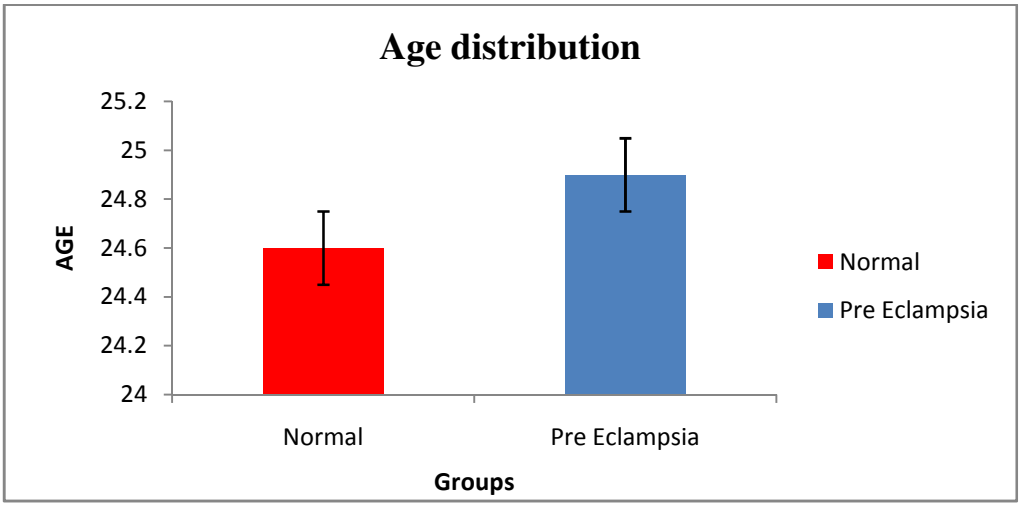
Table 1: Age distribution

Groups	Age	F value	P value
Normal	24.60 ± 3.44	2.06	0.15 (NS)
Pre Eclampsia	24.92 ± 4.44		

NS – Non significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 1: Age distribution



The physical parameters like weight and Height distribution were given in table 2&3 . There were no statistical difference in groups.

Table 2 : Weight distribution

Groups	Weight (kg)	F value	P value
Normal	67.52 ± 13.53	0.469	0.49 (NS)
Pre Eclampsia	63.5 ± 12.15		

NS – Non significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 2: Weight distribution

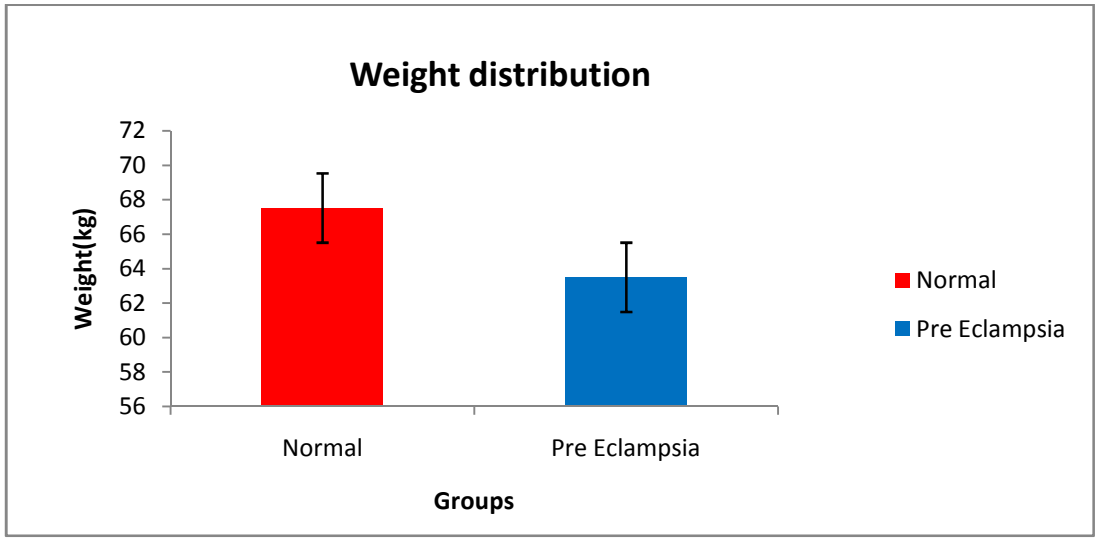


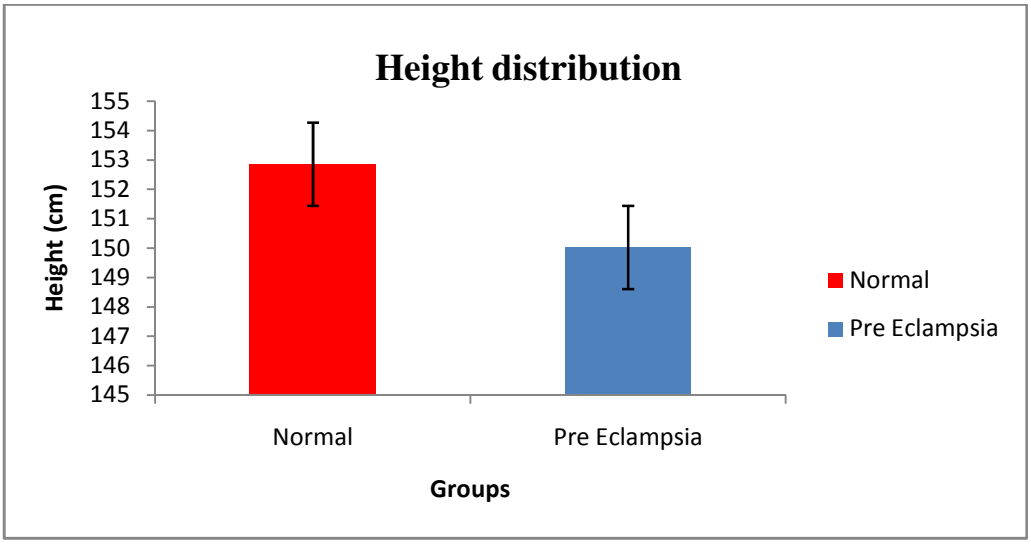
Table 3:Height distribution

Groups	Height (kg)	F value	P value
Normal	152.85 ± 8.22	0.546	0.46 (NS)
Pre Eclampsia	150.02 ± 8.76		

NS – Non significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 3:Height distribution



Their BMI ranged from 18.6 to 35.7. The mean BMI in normal and pre eclamptic groups is given in (Table 4).The BMI was more than 25 and less than 30 in the range of overweight in normal and pre eclamptic.The study participants were averege BMI28.93 ± 5.5 in normal group and 28.57 ± 6.97 in pre eclamptic group.

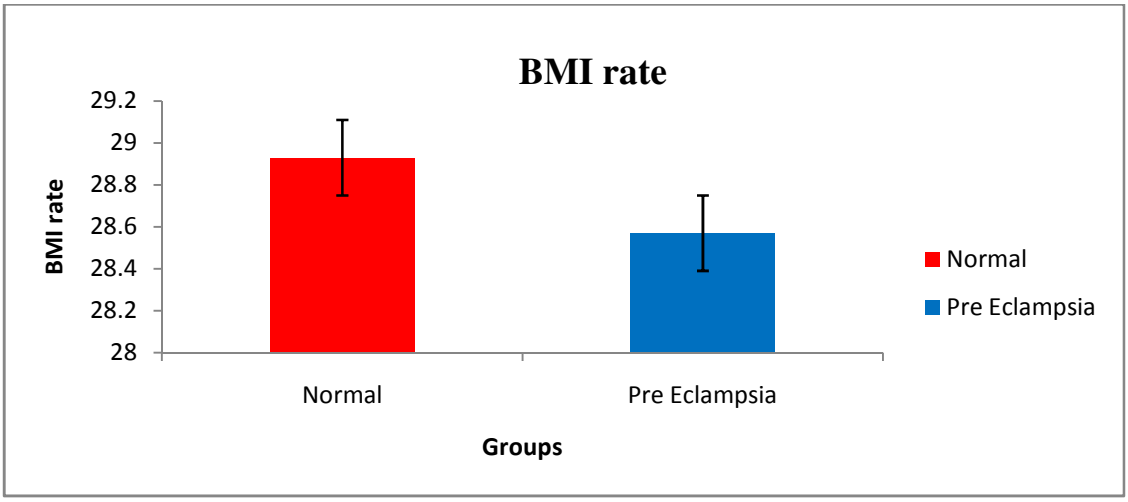
Table 4 : BMI rate

Groups	BMI rate	F value	P value
Normal	28.93 ± 5.5	3.207	0.07 (NS)
Pre Eclampsia	28.57 ± 6.97		

NS – Non significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figue 4 : BMI rate



The difference in gestational age showed in (Table 5). The difference between in normal and pre eclamptic group in gestational age was statistically highly significant $p<0.001$

Table 5 : Differences in gestational age (weeks)

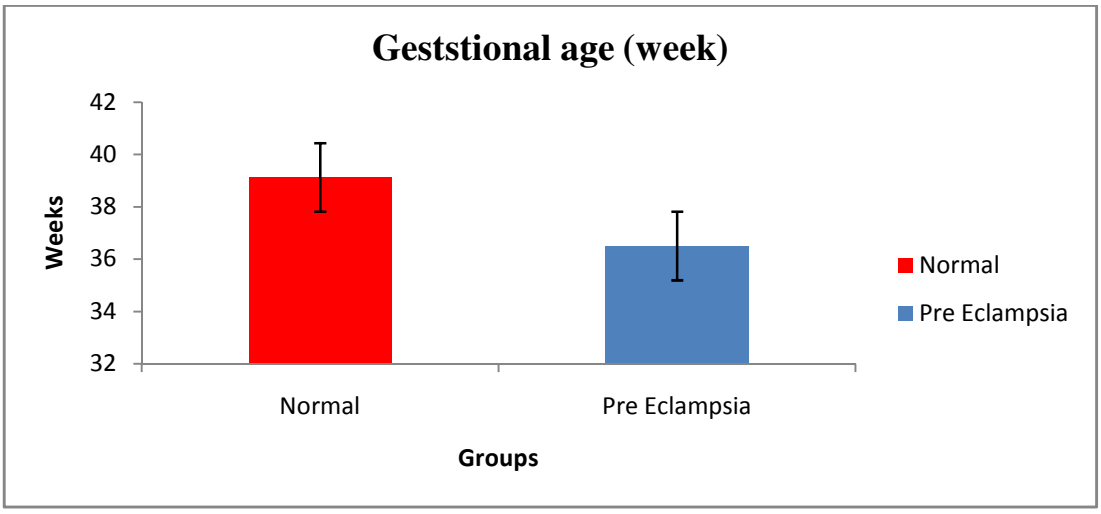
Groups	Gestational age (weeks)	F value	P value
Normal	39.12 ± 1.11	25.85	**0.001(HS)**
Pre Eclampsia	36.5 ± 2.16		

HS: Highly singnificant

Values are expressed as Mean ± SEM. n=40 p<0.05 considered as statistically significant

P<0.001 considered as statistically highly significant

Figure 5 : Differences in gestational age (weeks)



The spot protein /Creatinine ratio showed in table 6 & figure 6. The spot protein /Creatinine ratio was comparable in two groups, with a p value 0.122 which is non significant.

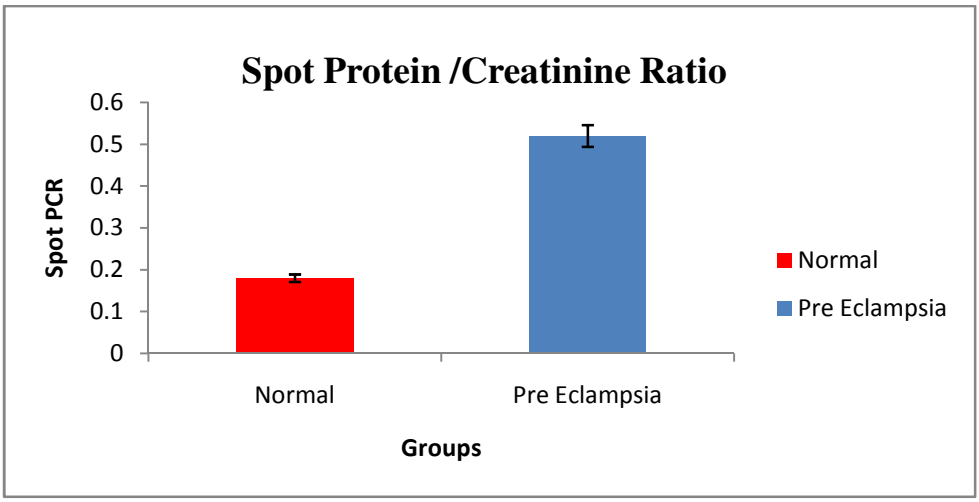
Table 6: Spot Protein /Creatinine Ratio

Groups	Spot Protein /Creatinine Ratio	F value	P value
Normal	0.18 ± 0.07	2.44	0.122(NS)
Pre Eclampsia	0.52 ± 0.09		

NS: Non significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 6: Spot Protein /Creatinine Ratio



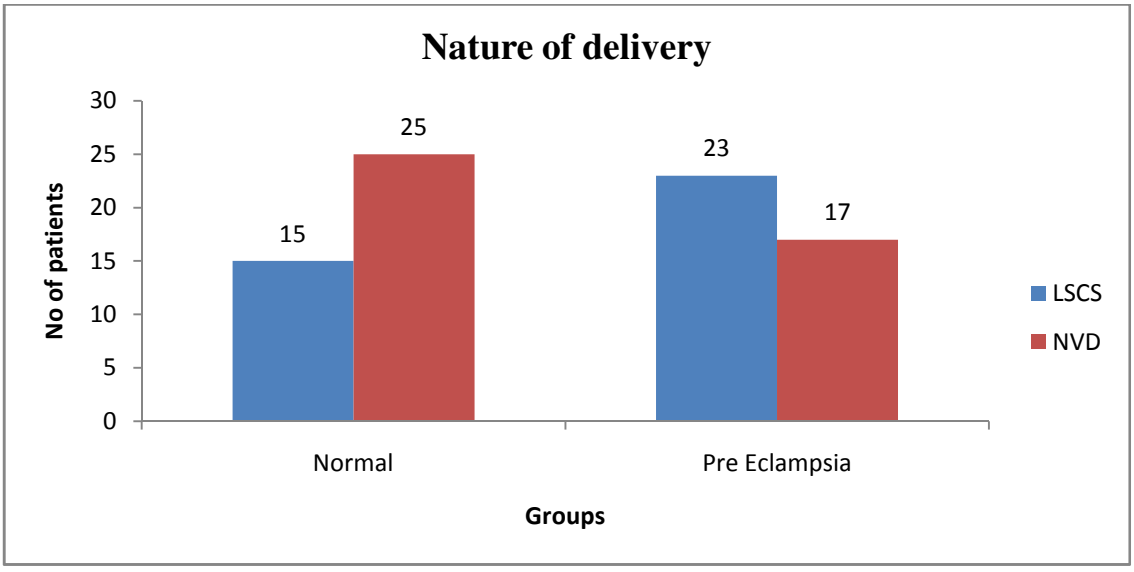
The nature of delivery showed in table 7 & figure 7. The maximum number of NVD reported in normal group 25 (62.5%). The maximum number of LSCSreported in Pre eclamptic group 23(57.5%). The nature of delivery was comparable in two groups with chi square test and statistically non significant with a p value 0.058.

Table 7: Nature of Delivery

	Nature of delivery		X^2 value	P value
Groups	LSCS (Lower segment Cesarian section)	NVD (Normal Vaginal Delivery)		
Normal	15(37.5%)	25(62.5%)	2.08	0.058 (NS)
Pre Eclampsia	23(57.4%)	17(42.5%)		
Total	38(47.5%)	42 (52.5%)		

NS: Non significant

Figure 7 : Nature of Delivery



The baby birth weight showed in table 8 & figure 8. The minimum average birth weight 2.72 ± 0.34 was observed in pre eclamptic groups. The difference between normal and pre eclamptic group was statistically significant with a p value 0.036.

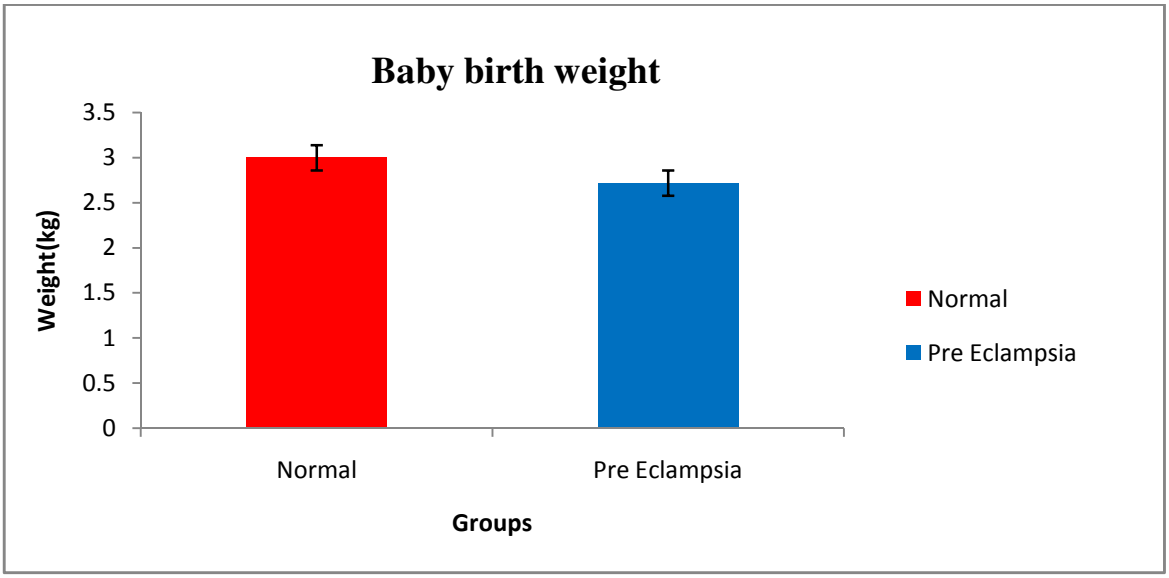
Table 8: Baby birth weight

Groups	Baby birth weight(Kg)	F value	P value
Normal	3.02 ± 0.27	4.56	**0.036 (S)**
Pre Eclampsia	2.72 ± 0.34		

S: significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 8: Baby birth weight



There was increased blood pressure observed in pre eclamptic patients both systolic and diastolic. There was statistically significant increase in systolic and diastolic BP between normal and pre eclamptic groups with a p value systolic (0.001) and diastolic (0.035).

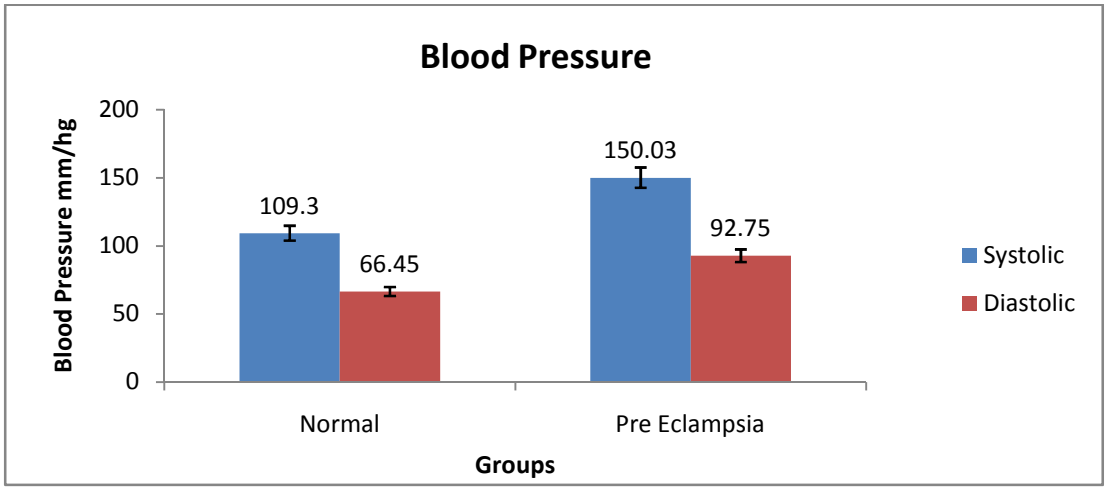
Table 9: Blood pressure difference in the groups

Blood Pressure	Groups		F value	P value
	Normal	Pre Eclampsia		
Systolic	109.3 ±7.90	150.03 ± 4.59	22.97	**0.001(HS)**
Diastolic	66.45 ± 6.91	92.75 ± 4.52	4.865	**0.035(S)**

HS: Highly Significant

Values are expressed as Mean ± SEM. n=40 p<0.05 considered as statistically significant P<0.001 considered as statistically highly significant.

Figure 9: Blood pressure difference in the groups



The comparison of systolic functions IVSs and IVS**d** were showed in(table 10 , 11 and figure 10,11).The results shown that there was statistically signifi cant reduction in systolic function. The difference between normal and pre eclamptic group was statistically significant in IVSs(p value 0.01) and IVSd (p value 0.01)

Table 10: Systolic function – IVSs (Interventricular Septal wall dimension – systole)

Groups	IVSs (cm)	F value	P value
Normal	1.20 ± 0.037	13.94	**0.01(S)**
Pre Eclampsia	1.02 ± 0.017		

S -Significant

Values are expressed as Mean ± SEM. n=40 p<0.05 considered as statistically significant

P<0.01 considered as statistically significant.

Figure 10 : Systolic function – IVSs (Interventricular Septal wall dimension – systole)

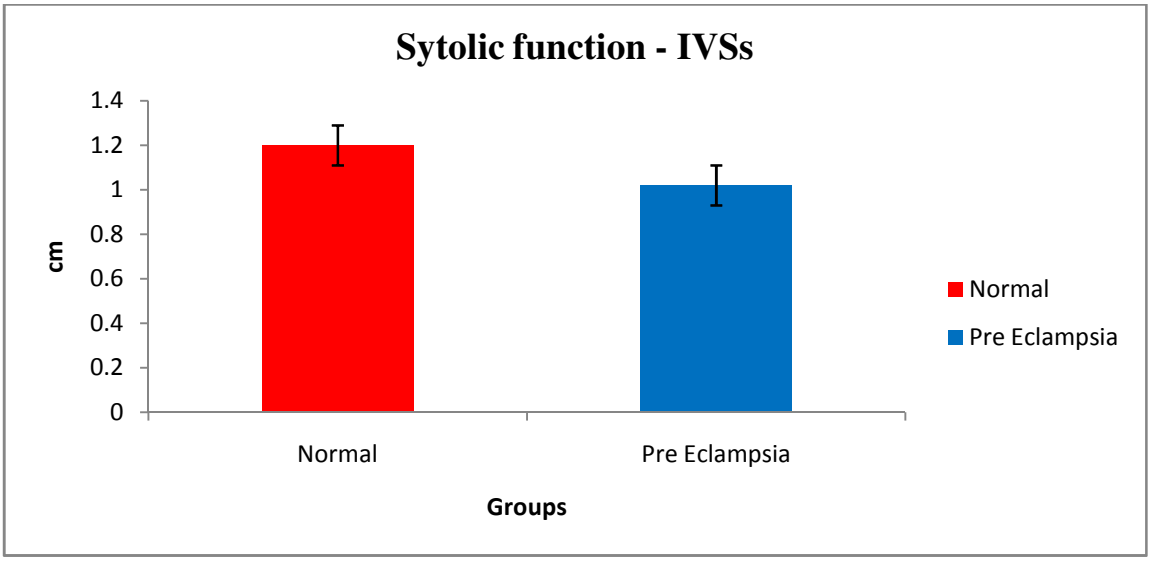


Table 11: Systolic function – IVSd (Interventricular Septal wall dimension – diastole)

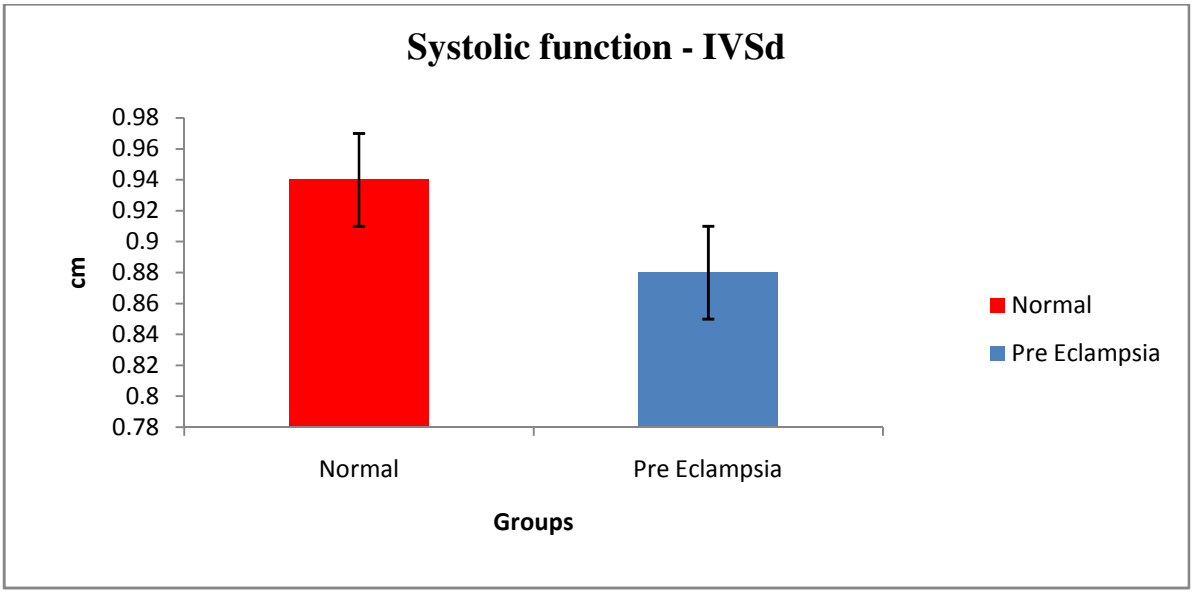
Groups	IVSd	F value	P value
Normal	0.94 ± 0.040	46.12	**0.01(S)**
Pre Eclampsia	0.88 ± 0.009		

S- Significant

Values are expressed as Mean ± SEM. n=40 p<0.05 considered as statistically significant

P<0.01 considered as statistically significant.

Figure11: Systolic function – IVSd (Interventricular Septal wall dimension – diastole)



The difference in ventricular function LPWs showed in table 12. The comparison between normal and pre eclamptic was statistically significant with a p value 0.022

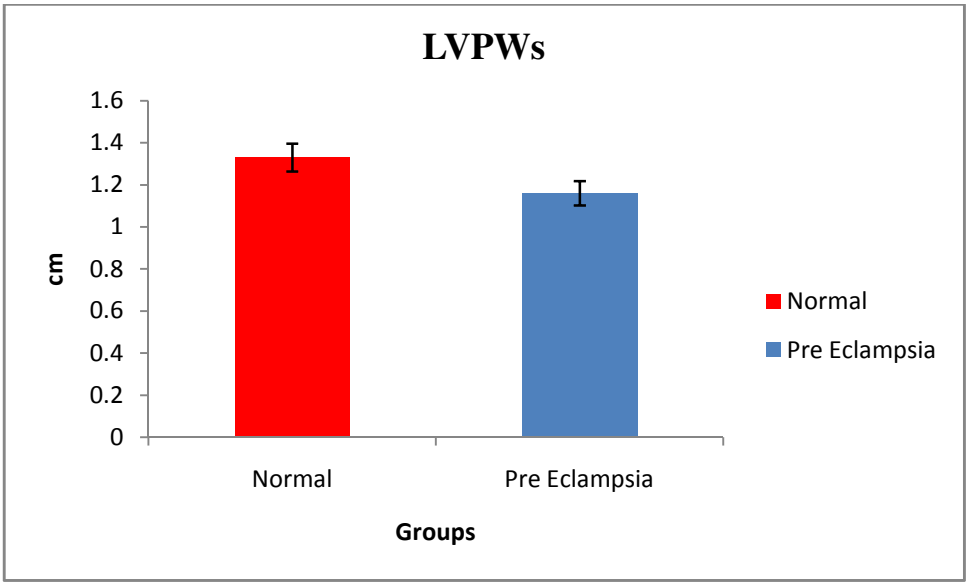
Table 12: Ventricular function- LVPWs (Left Ventricular posterior wall dimension – systole)

Groups	LVPWs (cm)	F value	P value
Normal	1.33± 0.036	5.44	**0.022(S)**
Pre Eclampsia	1.16 ± 0.024		

S- Significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 12: Ventricular function- LVPWs (Left Ventricular posterior wall dimension – systole)



The ventricular function LPWd in the normal group and pre eclamptic group were 0.99± 0.022 and 0.85 ± 0.017 respectively, which is not statistically significant p value 0.831

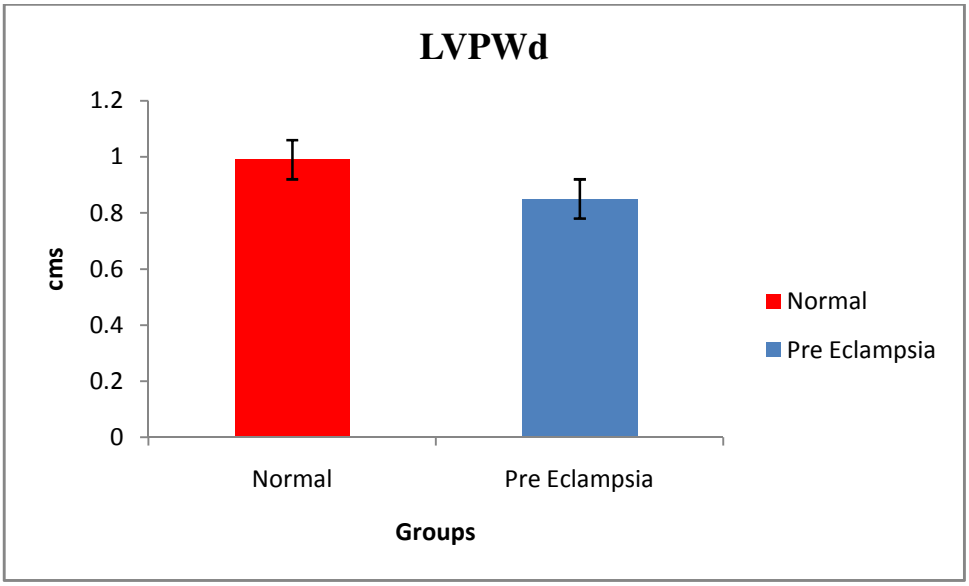
Table 13: Ventricular function - LVPWd (Left Ventricular posterior wall dimension – diastole)

Groups	LVPWd (cm)	F value	P value
Normal	0.99± 0.022	0.046	0.831(NS)
Pre Eclampsia	0.85 ± 0.017		

NS – Non Significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 13: Ventricular function - LVPWd (Left Ventricular posterior wall dimension – diastole)



The pecentage of Ejectiona fraction and Fractional shortening values given in table 14, 15 & figure 14, 15. The comparison between normal and pre eclamptic was statistically not significant and p value 0.484 and 0.396 respectively

Table 14: Percentage of Ejection Fraction value

Groups	EF value (%)	F value	P value
Normal	73.87 ± 1.11	0.496	0.484(NS)
Pre Eclampsia	64.95 ± 1.12		

NS: non singnificant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 14: Percentage of Ejection Fraction value

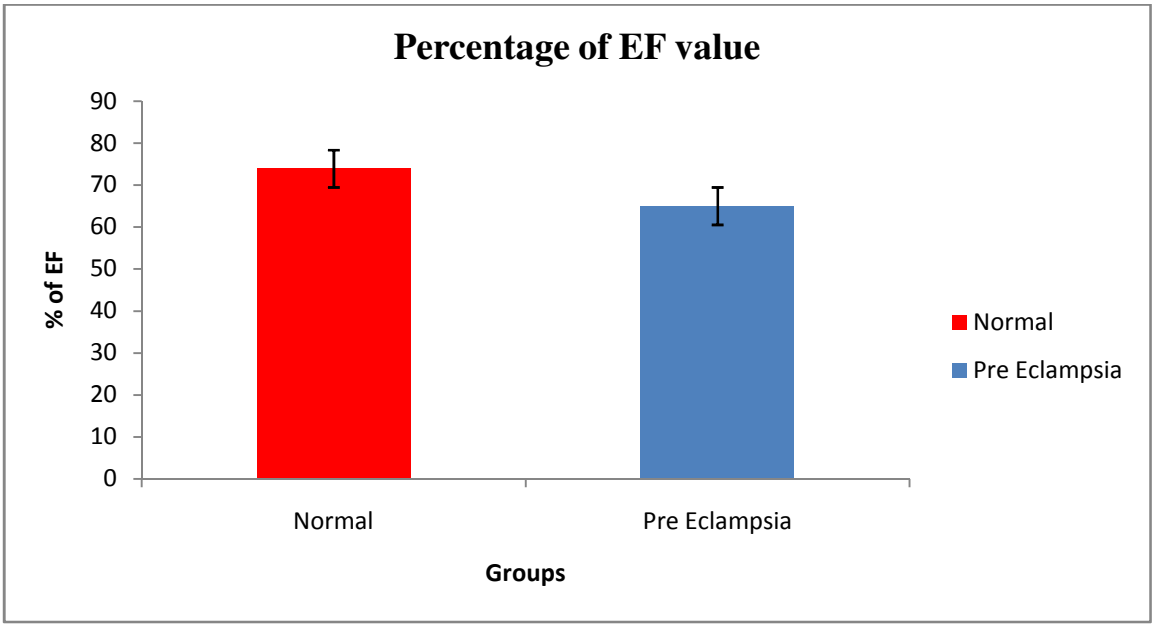


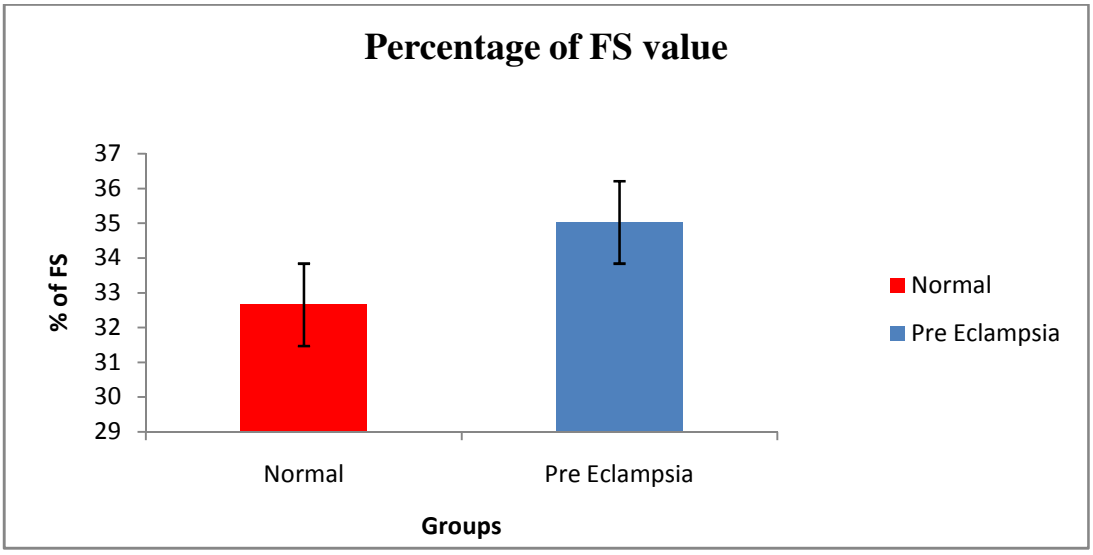
Table 15: Percentage of Fractional Shortening value

Groups	FS value (%)	F value	P value
Normal	32.65 ± 0.544	0.728	0.396(NS)
Pre Eclampsia	64.95 ± 0.634		

NS: Non significant

Values are expressed as Mean ± SEM. n=40 p<0.05 considered as statistically significant

Figure 15: Percentage of Fractional Shortening value



The results of E-wave, A – wave and E- wave / A –wave ratio were showed in table 16, 17, 18 and figure 16, 17, 18. The diastolic parameters E-wave, A – wave and E- wave / A –wave ratiowere increased in pre eclamptic patinets.The comparison between normal and pre eclamptic patients were statistically significant. The p value in E wave 0.042, A- wave 0.007 and E-wave /A- wave ratio 0.027.

Table 16: E - wave velocity

Groups	E wave velocity (msec)	F value	P value
Normal	83.6± 2.38	4.259	**0.042(S)**
Pre Eclampsia	78.67 ± 3.06		

S- Significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 16: E - wave velocity

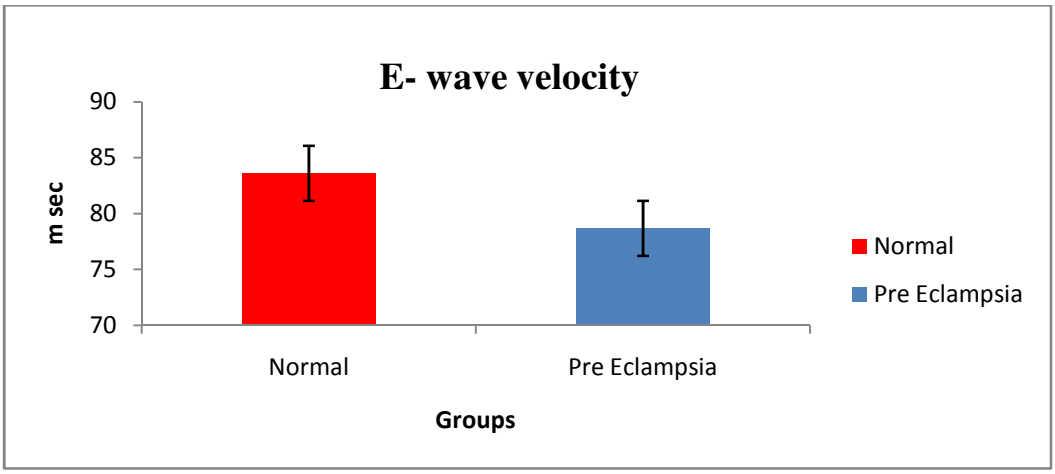


Table 17: A- wave velocity

Groups	A- wave velocity(msec)	F value	P value
Normal	60.97 ± 2.59	7.565	**0.007(S)**
Pre Eclampsia	72.54 ± 3.33		

S- Significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 17: A - wave velocity

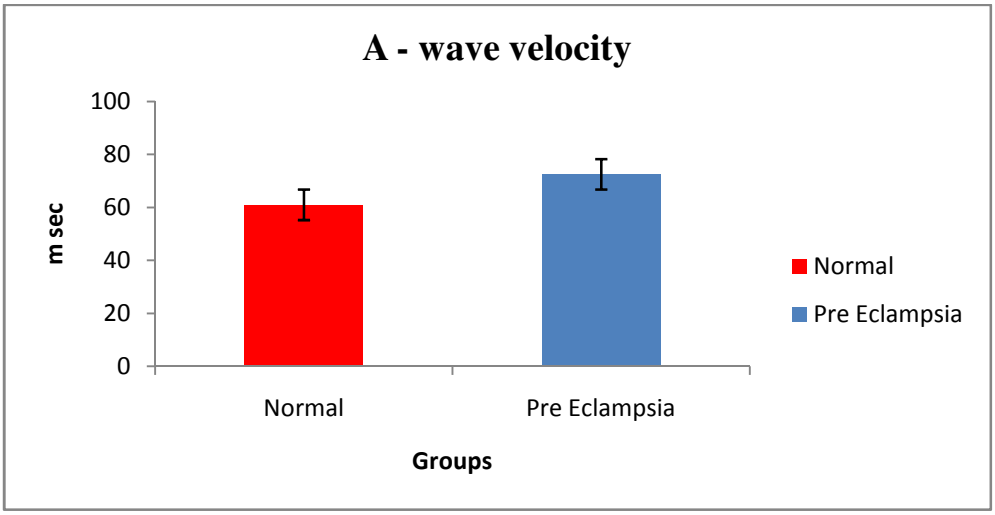


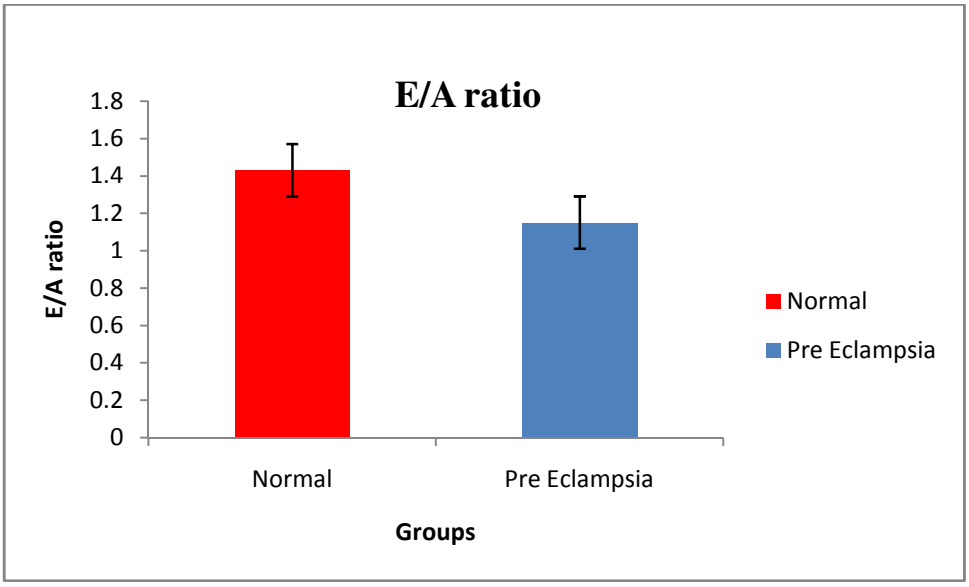
Table 18: E wave /A wave Ratio

Groups	E/A Ratio	F value	P value
Normal	1.43 ± 0.056	5.105	**0.027(S)**
Pre Eclampsia	1.15 ± 0.068		

S- Significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 18: E wave /A wave Ratio



The comparison of IVRT between Normal and preeclamptic patients were showed in table 19. The difference between in normal and pre eclamptic group in gestational age was statistically highly significant $p<0.001$

Table 19: IVRT (Isovolumetric Relaxation Time) value

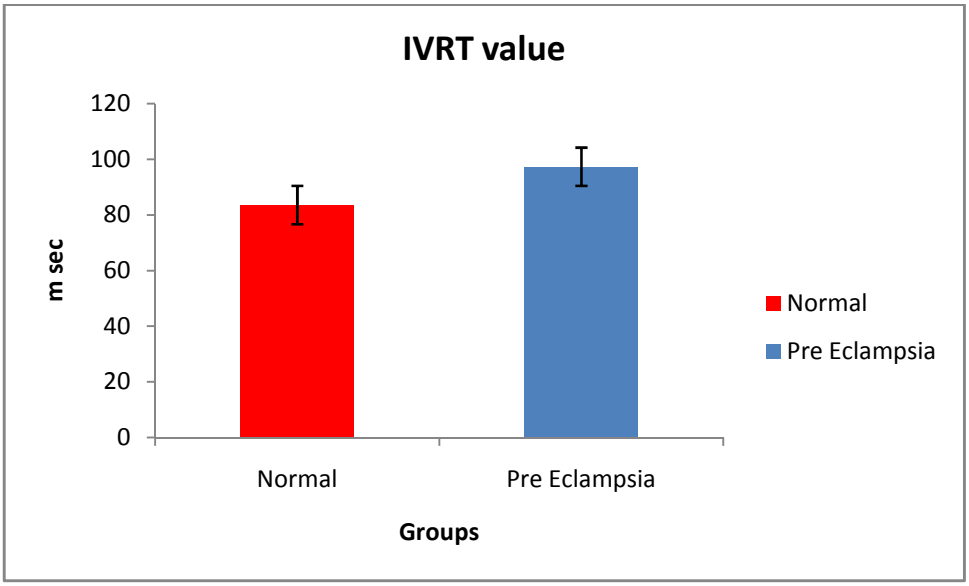
Groups	IVRT value(msec)	F value	P value
Normal	83.55 ± 2.27	13.60	**0.001(HS)**
Pre Eclampsia	97.35 ± 3.99		

HS: Highly Significant

Values are expressed as Mean ± SEM. n=40 p<0.05 considered as statistically significant

P<0.001 considered as statistically highly significant

Figure19: IVRT (Isovolumetric Relaxation Time) value



The comparison of AO and LA value showed in table 20 , 21 & figure 20, 21. The comparison between normal and pre eclamptic was statistically not significant and p value 0.668 and 0.749 respectively

Table 20: AO (Aortic root diameter) value

Groups	AO (cm)	F value	P value
Normal	2.903± 0.0256	0.185	0.668(NS)
Pre Eclampsia	2.925 ± 0.0264		

NS: non significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

Figure 20: AO (Aortic root diameter) value

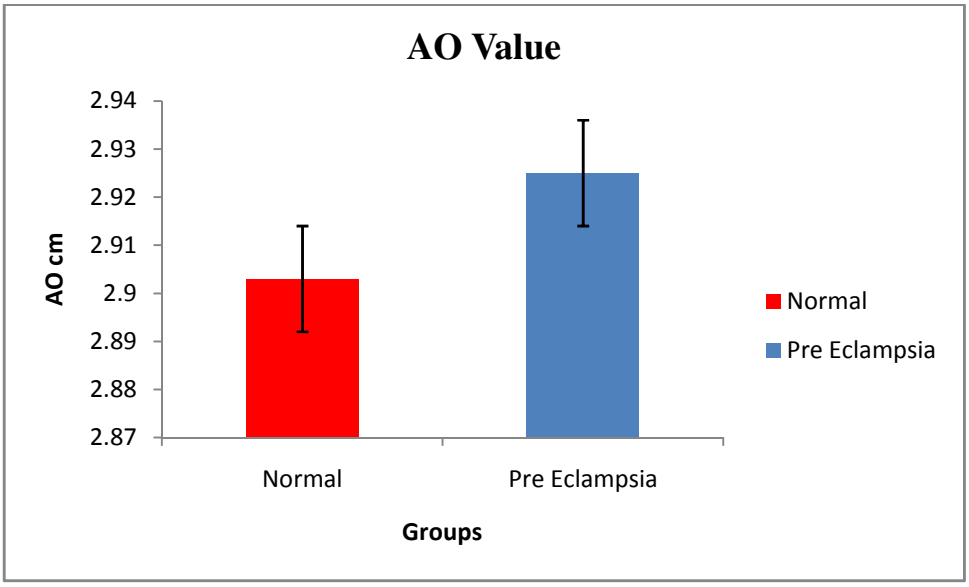


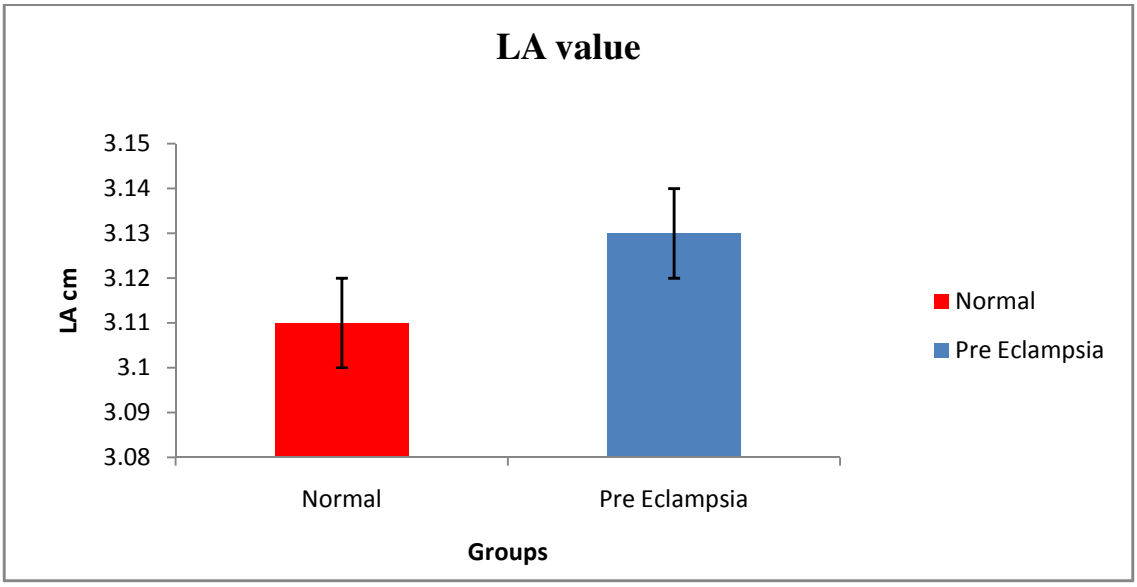
Table 21: LA (Left Atrium diameter) value

Groups	LA (cm)	F value	P value
Normal	3.11 ± 0.030	0.103	0.749(NS)
Pre Eclampsia	3.13 ± 0.029		

NS: non significant

Values are expressed as Mean ± SEM. n=40 $p<0.05$ considered as statistically significant

***Figure 21: LA (Left Atrium diameter) value**



Results:

S.No	Parameters	Normal	Pre eclamptic	P value
1	Age distribution	24.60 ± 3.44	24.92 ± 4.44	0.15 NS
2	Weight distribution	67.52 ± 13.53	63.5 ± 12.15	0.49 NS
3	Height distribution	152.85 ± 8.22	150.02 ± 8.76	0.46 NS
4	BMI rate	28.93 ± 5.5	28.57 ± 6.97	**0.07 (S)**
5	Gestational age	39.12 ± 1.11	36.5 ± 2.16	**0.001 (HS)**
6	Spot Protein /Creatinine Ratio	0.18 ± 0.07	0.52 ± 0.09	0.122 NS
7	Nature of Delivery			
	LSCS	15(37.5%)	23(57.4%)	0.058 NS
	NVD	25(62.5%)	17(42.5%)	
8	Baby birth weight	3.02 ± 0.27	2.72 ± 0.34	0.036 **(S)**
9	Blood pressure difference in the groups			
	Systolic	109.3 ±7.90	150.03 ± 4.59	**0.001 (HS)**
	Diastolic	66.45 ± 6.91	92.75 ± 4.52	0.035 **(S)**
10	Systolic function – IVSs	1.20 ± 0.037	1.02 ± 0.017	0.01 **(S)**
11	Systolic function – IVSd	0.94 ± 0.040	0.88 ± 0.009	0.01 **(S)**
12	Ventricular function-LVPWs	1.33± 0.036	1.16 ± 0.024	0.022 **(S)**
13	Ventricular function - LVPWd	0.99± 0.022	0.85 ± 0.017	0.831 NS

14	Percentage of Ejection Fraction value	73.87 ± 1.11	64.95 ± 1.12	0.484 NS
15	Percentage of Fractional Shortening value	32.65 ± 0.544	64.95 ± 0.634	0.396 NS
16	E - wave velocity	83.6 ± 2.38	78.67 ± 3.06	0.042 **(S)**
17	A - wave velocity	60.97 ± 2.59	72.54 ± 3.33	0.007 **(S)**
18	E wave /A wave Ratio	1.43 ± 0.056	1.15 ± 0.068	0.027 **(S)**
19	IVRT value	83.55 ± 2.27	97.35 ± 3.99	**0.001 (HS)**
20	AO (Aortic root diameter) value	2.903 ± 0.0256	2.925 ± 0.0264	0.668 NS
21	LA (Left Atrium diameter) value	3.11 ± 0.030	3.13 ± 0.029	0.749 NS

S – Significant, NS – Non significant, HS – Highly significant

DISCUSSION

The cardiovascular system undergoes significant changes in preeclamptic patients compared to normal healthy women.

In this study we have assessed the role of echocardiography and found it to be a useful technique for evaluation of maternal cardiac function in preeclamptic women. Rizwana *et al*. (2011) found that preeclampsia in women is characterized by high CO and a high vascular resistance state. This study confirms earlier studies that there were physiological changes in LV structure and function during normal pregnancy but that exaggerated physiological changes were seen in pregnant women with preeclampsia in third trimester.

Pregnancy represents a unique physiological condition in which heart undergoes morphological, hemodynamic, and functional adaptation with significant transient changes in cardiac loading conditions and work requirements. A through knowledge on maternal cardiac function during normal pregnancy is a prerequisite for identification of cardiac pathology in others. This is highly relevant since heart disease is one of the leading cause of non-obstetric mortality during pregnancy. In this thesis we studied the effects of hemodynamic changes during normal pregnancy on LV function by use of echocardiography and also hemodynamic changes and subclinical LV dysfunction in many preeclamptic patients

.Thus pregnancy is now considered a stress test to the maternal cardiovascular system. This study shows that women planning to become pregnant should be throughly screened for clinical and biochemical cardiovascular risk priorly and women presenting with clinical features of preeclampsia in pregnancy should be thoroughly investigated, and echocardiography should be done in all women, monitored periodically and treated according to recommendations.

Gilson *et al*. (1997) found no change in EF% and FS%, but the current study shows non significant increase in circumferential fiber shortening, which is due to increase in myocardial contractility.

In normal pregnancy there was an increase in preload as a result of increased blood volume, causing an increased E velocity and a low A velocity, but that was changed to high E-wave velocity and high A-wave velocity. The high E-wave velocity in preeclamptic women were observed suggests that transmitral pressure gradient during early passive filling is greater and reflects changes in passive myocardial compliance in the hypertrophic ventricle. The higher peak A-wave velocity in preeclamptic women suggests the more crucial role of the atrial systole in filling the hypertrophied ventricle in these patients.

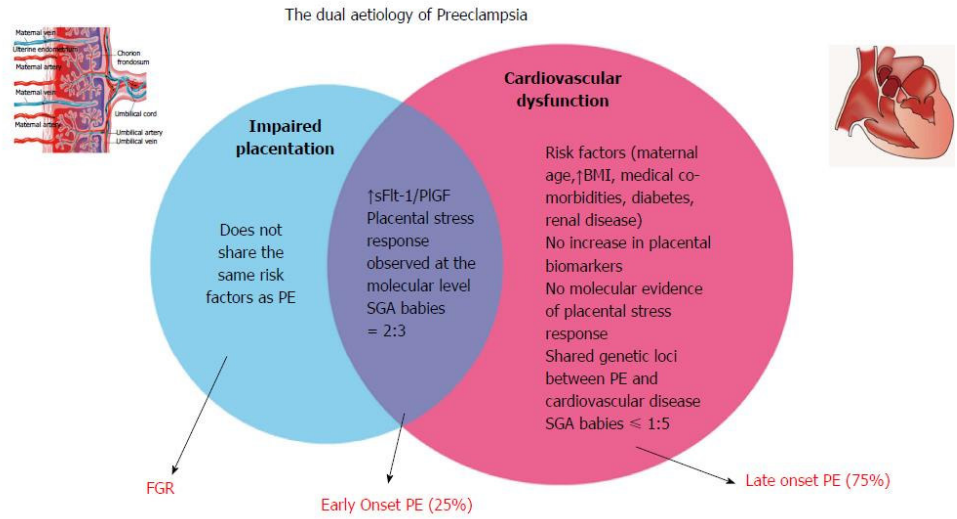
Butters *et al*.[23] reported that 67% of babies weighed less than the 10th percentile at birth after the mothers were treated for chronic hypertension.

In our study also we found the above changes, and also that preeclampsia in an earlier stage may lead to premature delivery and there is a higher rate of low birth weight. One limitation of this study is that it was not possible to follow up subjects in the postpartum period.

This study shows that there are significant structural and functional changes in the cardiovascular hemodynamics in patients with preeclampsia. It appears that BP monitoring alone is insufficient to effectively identify the risk of cardiovascular complications in these women. Maternal echocardiography, if introduced into the routine management protocol, could help to identify women who are at high risk of developing complications.

ETIOLOGY OF PREECLAMPSIA

Various etiological factors and hypothesis for pregnancy induced hypertension. The potential causes of pregnancy induced hypertension are,



1. Abnormal placentation (Steegers *et al.,* 2010)

2. Vasculopathy and inflammatory changes

3. Immunological factors

4. Genetic factors

5. Nutritional factors (Amir *et al*., 1998)

1. Abnormal placentation

According to Furuya *et al.,* 2008 the spiral arterioles of the placental bed undergo a series of physiological changes. These arterioles are invaded by trophoblast, which breaks down the endothelium, internal elastic lamina and muscular coat of the vessel, which is converted to fibrinoid layer in endothelium. These changes occurs in two phases, the invasion of decidual segments of spiral arterioles in the first trimester and myometrial segments, by a subsequent in the second trimester , second phase occurs.

These physiological changes convert the vessels supplying the placenta from muscular end arteries to wide mouth sinusoids, which are unresponsive to vasoactive substances and transformed into low pressure high flow system to meet the needs of the fetus and placenta.

According to Granger *et al*., 2001a; Furuya *et al.,* 2008 in PIH, there is inadequate maternal vascular response to placentation,and the primary invasion of trophoblast is partially impaired, and second phase of trophoblastic invasion fails to occur. This restriction of normal physiological changes, result in restricted placental flow, which becomes more severe with advancing gestation. Spiral arterioles show changes like endothelial damage, insudation of plasma constituents into vessel wall, proliferation of lipid laden myointimal cells and medial necrosis

termed acute atherosis. Obstruction of lumen by atherosis may impair placental blood flow. These changes pathologically decrease placental blood flow and lead to infarcts, patchy necrosis and intracellular damage to the synctiotrophoblast and obliterative endarteritis of fetal stem arteries finally leads to incomplete development of fetal macrovascular system in pregnancy induced hypertension associated with fetal growth restriction

2. Vasculopathy and inflammatory changes

Granger *et al*., 2001b says in response to ischemic changes, various noxious substances are released from the placenta and decidua, these are mediators to provoke endothelial injury. Cytokines such as(TNF-alpha) and interleukins contribute to the oxidative stress characterized by formation of reactive oxygen species (ROS) and free radicals that lead to formation of lipid peroxides. These free radical will damage endothelial cells, modify their nitric oxide production and interfere with prostaglandin balance. Oxidative stress also causes production of lipid laden macrophages foam cells seen in atherosis, activation of micro vascular coagulation seen in thrombocytopenia and increased capillary permeability seen in edema and proteinuria

3. Immunological factors

According to Chen *etal.,* 1993, 1994 .,Immunological factors also playscrucial role in the development of pre eclampsia. This factor include absence of blocking antibodies, decreased cell mediated immunity , involvement of cytokines and activation of neutrophils. An aberrant immune reaction between fetal trophoblast with maternal tissue in the placental bed is a fundamental factor in the etiology of preeclampsia ,which often complicates first pregnancy. Incidence is also increased when multiple partners and in a subsequent pregnancy after birth control methods. Women who develop PIH have decreased proportion of helper T cells (Th 1) in early second trimester, compared with normotensive individuals. The Th 1/Th 2 imbalance may be mediated by adenosine, found in higher concentration in pregnancy induced hypertension women. The helper lymphocytes secrete cytokines that promote implantation and their dysfunction may leads to pregnancy induced hypertension

4. Genetic factors

By Haram *etal*., 2000; Nilsson *et al.,* 2004Familial predisposition for preelampsia has been recognized, single gene model and polygenic inheritance has been suggested. In one swedish study, 60% concordance in monozygotic female twin pairs has been reported . It is also reported a HLA-DR4 association with proteinuria in pregnancy induced hypertension. A number of single gene mutation and inherited

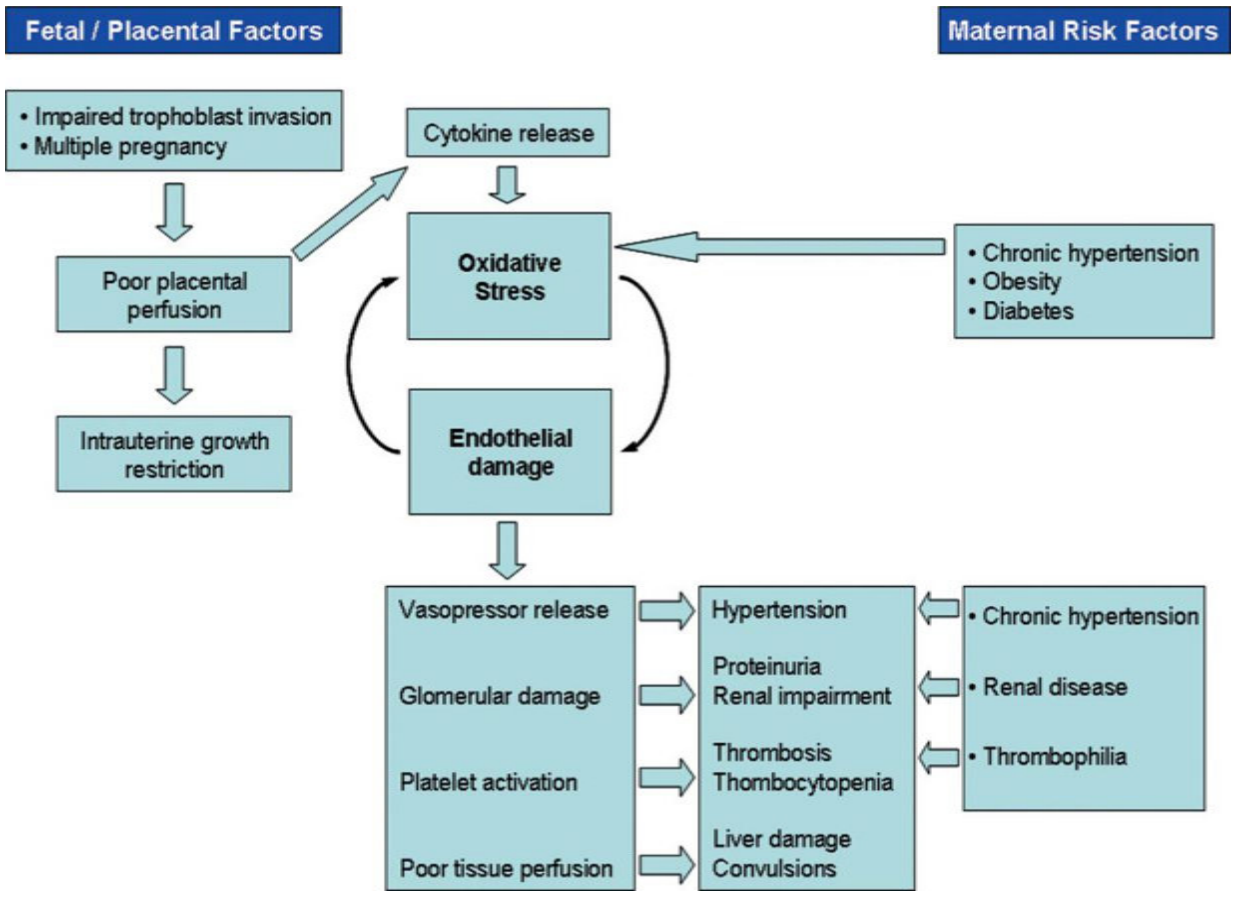
thrombophilia's may predispose to pregnancy induced hypertension. Polymorphisms of the genes for TNF, lymphotoxin-alpha and interleukin-1 have been studied with varying results

5. Nutritional factors

Many research shown that relationship between dietary deficiencies and incidence of preelampsia. A diet high in fruits and green leafy vegetables that have antioxidant activity is associated with decrease in the incidence of pregnancy induced hypertension. Antioxidants enzymes and antioxidant nutrients, includingcarotenoids, alpha-tocopherol and thiols are the primary defence against oxidative stress and free radical induced damage. Antioxidants protect against free radical damage and oxidative stress to endothelium by their quenching abilities. When there is deficiency of nutrients and antioxidant protective mechanisms,there is increase in production of lipid peroxidation. This imbalance leads to oxidative stress and tissue injury (Palan *et al.,* 2001).

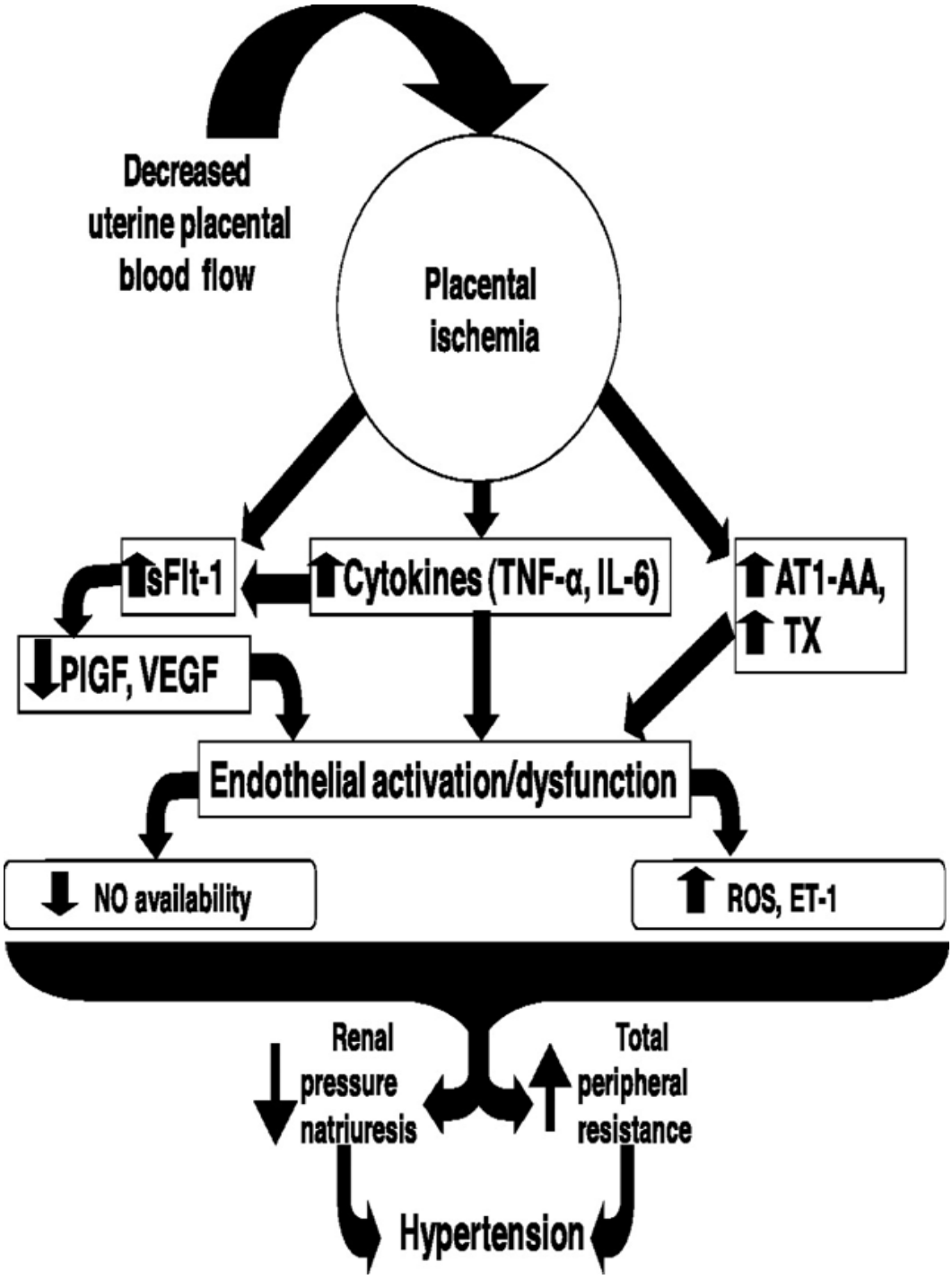
Sagol *et al*., 1999 states protective antioxidant systems are deficient in pregnancy induced hypertension and low maternal serum carotenoid level such as β carotenes; lycopene and canthaxanthin have been observed in pregnancy induced hypertension. Vitamin C and Vitamin E supplementation between 16 to 22 weeks gestation decreases the incidence of pregnancy induced hypertension by more than 50% (Chappell *et al*., 1999).

PATHOPHYSIOLOGY IN PREECLAMSIA



By Haram *et al*., 2000; Preeclampsia is characterized by vasospasm, endothelial cell damage resulting in activation of coagulation system

PATHOGENESIS OF PREECLAMPSIA



Vasospasm

A decrease in synthesis of nitric oxide (NO) and an increase in endothelin by the vascular endothelium in pregnancy induced hypertension couldaccountfor characteristic vasospasm which causes resistance and subsequent hypertension.Endothelial injury causes interstitial leakage through which blood constituents, including activated platelets and fibrinogen are deposited sub endothelially,results in diminished blood flow because of mal distribution;This ischemia of surrounding tissues would lead to necrosis, haemorrhage and other end organ disturbances characteristic of PIH

2. Endothelial cell activation

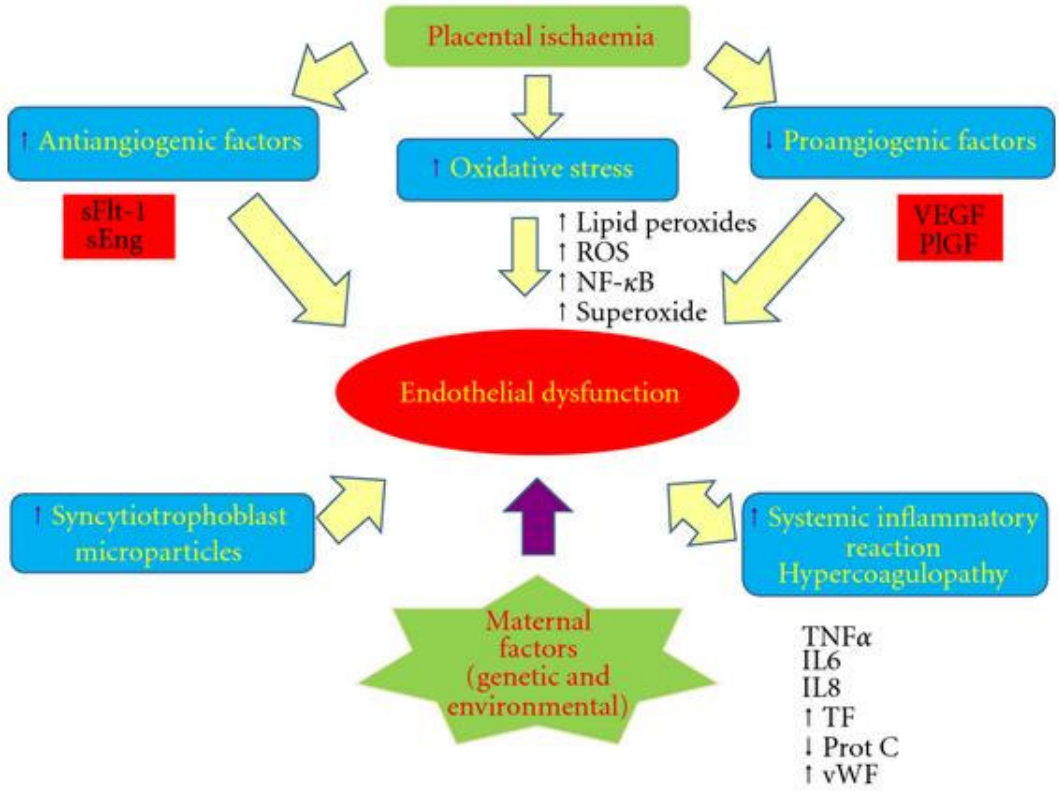
Various noxious placental cytokines andfree radicals generated by oxidative stress after ischemia of placenta cause activation and dysfunction of vascular endothelium. This Intact vascular endothelium decreases responsiveness to nitric oxide (NO) and to anticoagulant properties. Any injury or activation of endothelium secretes substances which promote coagulation and increased sensitivity to vasopressors. Increased circulating fibronectin, factor VII antigen and thrombomodulin, all markers of endothelial dysfunction are reported in pregnancy induced hypertension/preeclampsia (Granger *et al*., 2001b).

A) Enhanced pressor responses

Normal pregnant women are refractory to vasopressors like angiotensin II. However women with pregnancy induced hypertension/pre eclampsia have increased vascular reactivity to angiotensin II. This increased sensitivity precedes the onset of hypertension. Autoantibodies are thought to activate AT1 receptors and increased angiotensin II sensitivity. Up regulation of bradykinin receptors (B2) leads to heterodimerisation with angiotensin II type I receptors (ATI). ATI/B2 receptors have been shown to increase responsiveness to angiotensin II in-vitro.

B) Prostaglandins

Endothelial prostacyclin (PGI_2), a vasodilator; its production is decreased in pregnancy induced hypertension/pre eclampsia mediated by phospholipase A_2. Thromboxane A_2 (vasoconstrictor and platelet aggregator) levels are increased. Imbalance of prostaglandins, especially decreased prostacyclin: Thromboxane A_2 ratio , result in vasoconstriction and hypertension. In normal pregnancy, PGI_2 is more than TXA_2=Vasodilation=No hypertension. In Preeclampsia, PGI_2 is less than TXA_2=Vasoconstriction=hypertension (Chen *et al*., 1993).



E) Circulating angiogenic factors

Vascular endothelial growth factors (VEGF) and placental growth factor are endothelial specific growth factors plays a crucial role in promoting angiogenesis; Activity of VEGF is mediated by interaction with two high affinity receptor tyrosine kinases: Kinase insert domain region (KDR) and fms like tyrosine kinase-1 (flt-1).These are expressed an endothelial surface. Alternative splicing of flt-1 results in over production of sflt-1; this leads to loss of attachment to cell membranes and is secreted in to the maternal blood. This will antagonize VEGF and

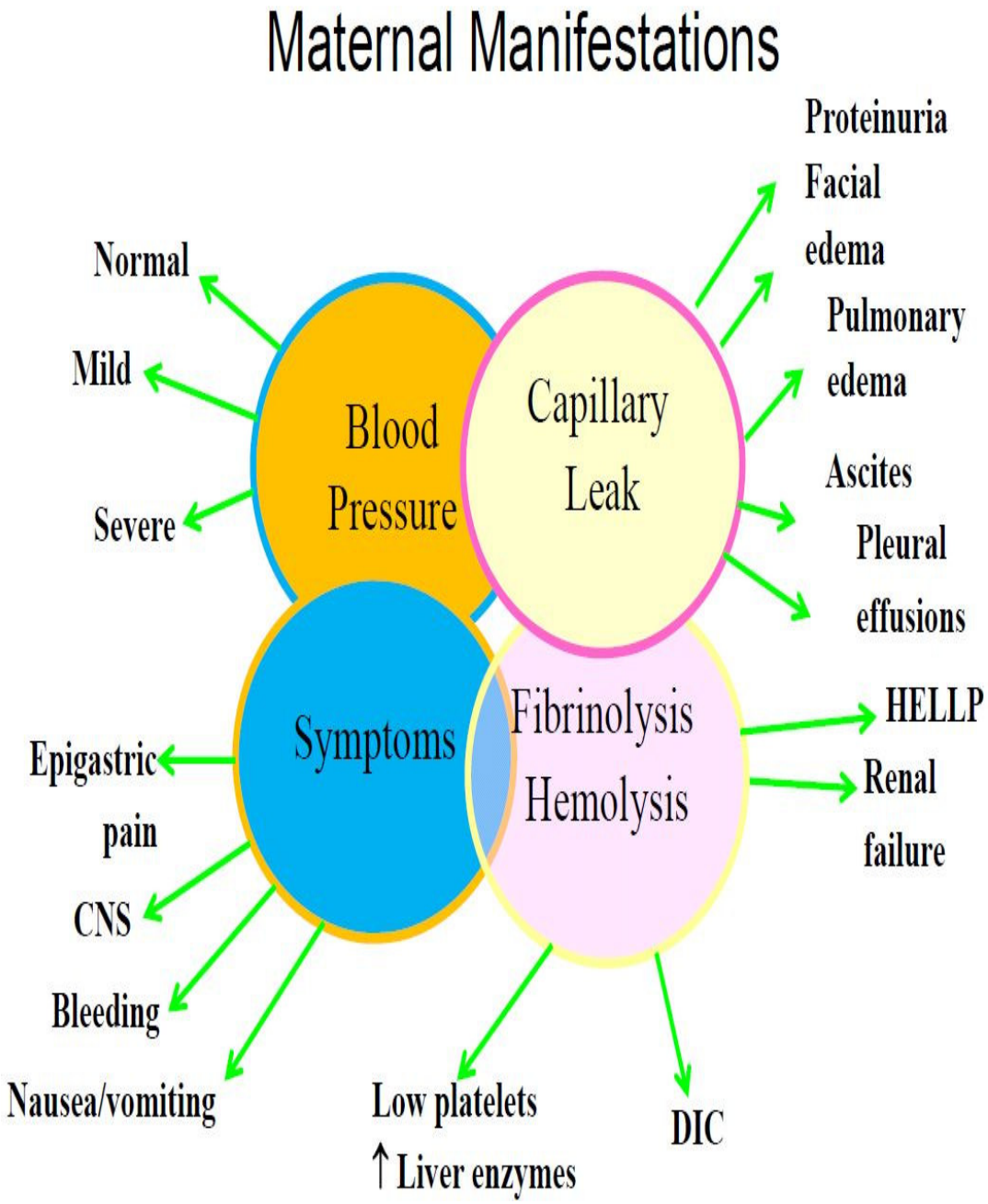
PLGF by binding to it and preventing its interaction with endogenous receptors. Excess sflt-1 production is seen in pregnancy induced hypertension/pre eclampsia placentas, which creates an antiangiogenic state and plays a causal role in the pathogenesis of maternal syndrome in pregnancy induced hypertension/pre eclampsia. PLGF is important in vasculogenesis and control of microvascular permeability (Wang *et al*., 2009).

As explained above, pregnancy is hemodynamically characterized by increased blood volume, plasma volume ,cardiac output and heart rate, as well as a decrease in blood pressure and peripheral vascular resistance. However, preeclampsia, an entity with significant fetal risk, maternal morbidity and mortality, is characterized by high blood pressure and less vasodilatation than that observed in normal pregnancy. Pathology shows that the systemic arteries of preeclamptic women are significantly stiffer than observed in healthy pregnant women at term, and moreover, that this phenomenon persists 6 months postpartum , according to various study reports.

Cardiovascular diseases like hypertension and hypercholesterolemia , diabetes increase with advancing age and it is associated with ventricular and arterial stiffening. The changes in characteristic impedance and compliance we observed in patients with

preeclampsia bears a similarity to patients as a result of aging, hypertension, and arteriosclerosis. Hence, our results provide further insight into the pathophysiological basis for the increased risk of cardiovascular events in women with previous history of hypertension and previous h/o preclampsia .

The changes in circulating blood volume, plasma volume and cardiac output and changes in blood pressure, peripheral vascular resistance, compliance, myocardial function, heart rate and the neurohormonal system, all allow the cardiovascular system to meet the increased metabolic demands during pregnancy.


Maternal Manifestations
Proteinuria
Facial edema
Pulmonary edema
Ascites
Pleural effusions
Normal
Mild
Severe
Blood Pressure
Capillary Leak
Symptoms
Fibrinolysis Hemolysis
HELLP
Renal failure
Epigastric pain
CNS
Bleeding
Nausea/vomiting
Low platelets
↑ Liver enzymes
DIC

This thesis shows that we non-invasive echocardiographic evaluation of left ventricle combined with good clinical history and relevant blood investigations add important information on the interaction of the heart with systemic vasculature in patients susceptible for gestational cardiovascular disorders like preeclampsia, hypertension and peripartumcardiomyopathy.

Furthermore, maternal hemodynamic variables also influence fetal growth and thereby current and future health of the newborn . Finally, hemodynamic monitoring during pregnancy may add to the current risk stratification tools in terms of predicting future cardiovascular disease to the respective patient. Insight into the mechanisms of physiological changes in normal pregnancy is essential in follow up of pregnant women with maternal structural heart disease like congenital heart diseases and other valvular and ischemic heart diseases during pregnancy.

Limitations

1. Preconceptional data would be the preferred reference measurements for assessing hemodynamic alterations during pregnancy, since we know that the major changes occurs during the first 12 weeks of pregnancy is not obtained .

We didn't followed the patients during post partum period and repeat follow up echocardiographic monitoring not done to assess the period when is the preeclamptic patients with high hemodynamic alterations and morphology of heart ,return to baseline.

Oral and hormonal contraceptives during preconceptional usuage and post partum period might have influence on hemodynamic variations and pathology of preeclampsia and unfortunately we lack information. Furthermore, we do not have access to pregestational data like socio economic status and living conditons and dietaryin any of the study groups, which describes any inference of cause-effect relationship between development of preeclampsia and persisting hypertension in previous preeclamptic women.

Longitudinal data during pregnancy in preeclamptic women would be preferable rather than single third trimester echo in order to detect hemodynamic changes very early in pregnancy that may be present before preeclampsia becomes clinically overt and which ones that occurs after clinical manifestation of the disorder.

Furthermore, studies of larger size than this, would make it possible to study hemodynamic changes in subgroups of preeclamptic women like those with early and late onset preeclampsia,mild and severe preeclampsia with or without fetal growth restriction and with or without pre-existing metabolic disorders like diabetes and metabolic syndrome.

CONCLUSION

1. During normal pregnancy, profound alterations in LV function occur. Increases in circulating blood volume are reflected by increased CO and cardiac dimensions. LV contractility is significantly reduced, whereas filling pressures (e/e') are unchanged. These findings suggest that pregnancy represents a larger load on the cardiovascular system than previously assumed. Reference values obtained are relevant in order to identify cardiovascular dysfunction in pregnant women with heart disease.

2. During normal pregnancy there is an increase in cardiac output, and decrease in blood pressure and peripheral arterial resistance whereas central aortic properties are less altered. The increased ventriculoarterial coupling index ($E_aI/E_{LV}I$) during normal pregnancy indicates a decrease in LV function not fully compensated for by vascular adaptation.

3. Blood pressure measured repeatedly by two different noninvasive devices during pregnancy and postpartum showed a statistically significant drop in mid-pregnancy, followed by a progressive increase until term. The lack of the mid-trimester drop in blood pressure might play a predictive role for a subsequent development of early-onset preeclampsia.

4. Women with established preeclampsia are characterised by a higher resistance in the entire arterial system. The altered arterial properties persisted after six months and were also elevated three years postpartum in women with previous preeclamptic pregnancy. These changes indicate that preeclampsia induces persistent cardiovascular disturbances.

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PROFORMA

1. NAME
2. AGE
3. IP NO
4. OBSTETRIC CODE
5. DATE OF ADMISSION
6. LMP:
7. EDD:
8. DATING SCAN
9. ASSOCIATED RISK FACTORS
10. CLINICAL EXAMINATION WT, HT , BMI , CLINICAL FINDINGS
11. VITALS MONITORING BP ,PR
12. ECG FINDINGS
13. MODE OF ONSET OF LABOUR SPONTANEOUS/INDUCTION/ LSCS
14. ECHOCARDIOGRAPHIC FINDINGS SYSTOLIC AND DIASTOLIC FUNCTION OF LEFT VENTRICLE IN THIRD TRIMESTER
15. GESTATIONAL AGE AT DELIVERY
16. MODE OF DELIVERY VAGINAL DELIVERY CESAREAN SECTION INDICATION
17. BIRTH WEIGHT

MASTER CHART										
NAME	AGE	OBS CODE	WEIGHT	HEIGHT	BMI	GES AGE at deli	BP	SPOT PCR	DELIVERY	BT WT
PATCHAIAMMAL	23	G2A1	68	144	32.8	35	150/100	0.4	LSCS	2.5
RANI	22	PRIMI	45	145	21.4	35	150/90	0.4	LSCS	2.4
VALLI	19	PRIMI	55	160	21	37	150/100	0.5	NVD	2.8
YUVARANI	24	G2P1LI	64	154	27	34	150/100	0.5	LSCS	2.2
GOMATHI	26	G2A1	70	153	29.9	38	150/90	0.4	NVD	3
RENUGA	28	G3A2	73	150	32.4	37	150/90	0.6	LSCS	3.1
VENI	23	G2P1LI	93	150	41.3	36	160/100	0.6	LSCS	2.2
KOTHAI	21	PRIMI	104	157	42.2	39	150/90	0.5	LSCS	2.9
ARUNA	19	PRIMI	50	154	21.1	38	150/90	0.5	NVD	3
RADHA	29	G2A1	62	158	24.8	39	150/90	0.4	NVD	2.7
ANUSHIUYA	30	PRIMI	70	145	33.3	34	150/90	0.6	LSCS	2.2
SHRUTHI	26	G3P2L2	73	143	35.7	34	160/100	0.4	NVD	2.9
AISHWARYA	24	PRIMI	80	140	40.8	35	150/90	0.5	LSCS	2.4
KUPPAMMAL	23	G2A1	69	156	28.4	38	150/90	0.5	LSCS	3
DHIVYA	22	PRIMI	64	164	23.8	39	150/90	0.4	NVD	3.1
SUGANYA	19	PRIMI	72	135	39.5	39	140/100	0.6	LSCS	3.2
ALAMELU	18	PRIMI	57	167	20.4	37	150/90	0.7	NVD	2.7
SUBBU	25	G2P1LI	54	146	25.3	39	140/90	0.4	LSCS	3.1
RAMYA	30	PRIMI	68	135	37.3	35	150/100	0.5	LSCS	2.5
SELVI	18	PRIMI	45	168	15.9	37	150/90	0.7	NVD	2.8
ROSY	26	G2A1	48	157	19.5	39	150/90	0.5	LSCS	2.6
SENGAMMAL	24	PRIMI	54	167	19.4	39	150/90	0.6	LSCS	3.1
ALIYA	30	PRIMI	80	162	30.5	36	150/90	0.7	LSCS	2.8
FAREENA	23	PRIMI	45	153	19.2	38	150/90	0.5	NVD	3.2
SHERLY	24	G2P1LI	56	150	24.9	37	150/100	0.7	LSCS	3
KALPANA	24	PRIMI	65	152	28.1	38	150/90	0.5	LSCS	2.8
VISHNU	20	PRIMI	54	151	23.7	39	150/90	0.5	NVD	3
MARIYAMMAL	19	G2A1	49	153	20.9	35	150/90	0.5	LSCS	2.4
CHANDRA	32	PRIMI	73	146	34.2	35	150/90	0.7	LSCS	2.6
SHANTHI	21	PRIMI	46	157	18.7	37	150/90	0.6	NVD	3.5
PRASANNA	33	G2P1LI	70	140	35.7	34	160/100	0.4	NVD	2.6
CHITHRA	22	G2A1	48	139	24.8	32	150/90	0.5	NVD	2
VASANTHI	32	PRIMI	65	146	30.5	34	160/90	0.5	LSCS	2.4
MUNIYAMMAL	29	PRIMI	57	142	28.3	33	150/90	0.7	NVD	2.2
NILOFER	30	G2P1LI	76	148	34.7	34	140/100	0.5	LSCS	2.3
RANJITHA	25	G2A1	54	136	29.2	39	150/90	0.6	NVD	2.6
NANDHINI	23	PRIMI	59	138	31	38	150/90	0.5	NVD	2.6
KUPPU	33	G3P2L2	77	145	36.6	37	140/100	0.6	LSCS	2.6
SARANYA	32	PRIMI	63	147	29.2	39	150/90	0.4	LSCS	2.9
AMUDHA	26	PRIMI	65	148	29.7	32	150/90	0.5	NVD	2.8

	SYSTOLIC FUNCTION						DIASTOLIC FUNCTION					
NAME	IVSs	IVSd	LVPWs	LVPWd	EF	FS	E msec	A msec	E/ARATIO	IVRT	AO cm	LA cm
PATCHAIAMMAL	1.1	0.85	1.4	0.9	55	28	62	96	0.65	116	2.9	3.1
RANI	1.1	0.86	1.2	1.1	65	34	90	60	1.3	90	3	3.1
VALLI	1.4	0.98	1.3	0.9	70	35	70	96	0.51	130	2.9	3
YUVARANI	1.12	0.8	1.36	0.92	68	40	64	47	1.3	80	2.9	3.2
GOMATHI	1.14	0.93	1.01	0.9	65	43	88	56	1.5	60	3	3.3
RENUGA	1.14	0.86	1.38	0.8	67	34	92	55	1.6	70	2.8	2.9
VENI	1.06	0.87	1.1	0.92	68	36	54	120	0.45	140	2.9	3.3
KOTHAI	1.04	0.8	1.3	1.1	70	29	78	56	1.3	75	2.9	3.3
ARUNA	1.05	0.9	1.3	1	77	40	92	62	1.3	67	2.8	3.3
RADHA	1.04	0.98	1.2	0.9	76	37	78	56	1.3	80	3	3.1
ANUSHIUYA	0.94	0.9	1.4	0.82	75	39	60	50	1.2	82	2.7	3.2
SHRUTHI	0.93	0.84	1.2	0.84	70	32	54	120	0.45	130	3	3
AISHWARYA	0.94	0.87	1.3	0.9	65	34	62	96	0.65	116	2.9	3.1
KUPPAMMAL	0.8	0.77	1.3	1.1	70	39	64	98	0.66	160	2.9	3
DHIVYA	0.84	0.8	1.2	0.92	55	35	120	90	1.3	86	2.8	3
SUGANYA	0.89	0.81	1.3	0.93	58	37	50	90	0.55	120	2.9	3
ALAMELU	0.97	0.92	1.2	0.91	60	31	90	62	1.4	90	3	3.1
SUBBU	0.98	0.9	1.1	0.8	58	29	50	85	0.58	116	3.1	3.4
RAMYA	0.94	0.8	1.2	0.76	53	28	50	80	0.62	120	3	3.1
SELVI	1.1	0.82	1.3	0.78	58	28	120	80	1.5	100	3.2	3
ROSY	1.14	0.94	1.3	0.91	60	34	90	62	1.4	90	2.8	2.9
SENGAMMAL	1.1	0.99	1.2	0.87	63	35	52	96	0.52	130	2.7	3
ALIYA	1.04	0.86	1.2	0.91	64	36	80	50	1.6	80	2.7	2.8
FAREENA	1.12	0.93	1.1	0.86	67	39	64	47	1.36	90	3	3.1
SHERLY	1.03	0.88	1.2	0.84	74	40	90	54	1.6	86	3.1	3.2
KALPANA	1.03	0.84	0.9	0.6	73	41	98	60	1.6	86	3	3.2
VISHNU	1.12	0.87	1.09	0.8	64	40	96	72	1.3	96	3.2	3.6
MARIYAMMAL	1.12	0.91	1.03	0.86	58	36	76	90	0.84	80	3.2	3.5
CHANDRA	0.84	0.95	1.2	0.9	60	29	120	80	1.3	86	2.9	3.2
SHANTHI	0.94	0.9	1.3	0.91	76	34	80	70	1.15	80	3	3.4
PRASANNA	0.93	0.8	1	0.8	75	39	60	98	0.61	140	3.1	3.2
CHITHRA	0.94	0.87	1	0.71	73	37	76	92	0.82	98	2.9	3.3
VASANTHI	0.94	0.85	0.9	0.81	70	37	64	98	0.66	160	2.9	3
MUNIYAMMAL	0.96	0.83	0.8	0.7	50	30	64	47	1.36	80	3.1	3.1
NILOFER	0.93	0.82	0.9	0.65	55	31	90	54	1.6	90	2.6	2.8
RANJITHA	1.05	0.8	0.9	0.64	60	32	99	61	1.62	80	2.9	3.3
NANDHINI	1.04	0.94	1.1	0.9	63	34	86	50	1.7	80	3.1	3.2
KUPPU	1.03	0.93	1.2	0.75	62	38	94	54	1.7	74	2.7	2.9
SARANYA	1.04	0.93	1.1	0.8	60	36	94	60	1.65	80	2.4	2.8
AMUDHA	1.03	0.9	1.1	0.91	68	35	86	50	1.7	80	3.1	3.2

MASTER CHART

NAME	AGE	OBS CODE	WT	HT	BMI	GES AGE at deli	BP	SPOT PCR	DELIVERY	BABY WT
KAVITHA	24	PRIMI	46	155	19.1	40	100/60	0.2	NVD	2.8
SHANMATHY	19	G2P1L1	53	145	25.2	39	110/70	0.2	LSCS	2.9
AROGYANITHYA	23	G2P1L1	58	143	28.4	38	100/60	0.1	NVD	3
PAVITHRA	25	G4P2L1A1	67	156	278.5	39	120/70	0.3	NVD	3.1
MEENA	26	G2P1L1	65	153	27.8	40	100/70	0.2	LSCS	2.8
JOTHI	30	G3P2L2	79	154	33.3	40	100/60	0.1	NVD	2.9
AISHWARYA	23	PRIMI	80	165	29.4	41	120/80	0.3	NVD	3
MEENA	19	G2P1L1	76	154	32	38	110/70	0.3	NVD	3.2
SUGANYA	27	PRIMI	72	143	35.2	39	110/60	0.1	LSCS	3.4
HAJEERA	28	G3A2	56	140	28.6	40	112/56	0.1	LSCS	3.5
SHOBANA	23	G2P1L1	49	145	23.3	41	116/80	0.2	NVD	2.8
MEHRUN	22	PRIMI	54	167	19.4	39	114/50	0.3	NVD	3.1
ANJALI	21	G3P2L2	59	156	24.2	37	120/60	0.2	NVD	3
SATHYA	28	PRIMI	50	151	21.9	38	110/68	0.2	NVD	3.2
RAHMAD NISHA	30	G3P2L2	59	150	26.2	39	110/68	0.2	NVD	2.9
ILAVARASI	31	G2A1	67	156	27.5	40	120/70	0.1	NVD	2.8
AISHA BANU	24	PRIMI	79	154	33.3	38	120/68	0.3	NVD	3
GOMATHY	23	PRIMI	80	165	29.4	39	110/60	0.2	NVD	3.2
DHIVYA RANI	21	G3P2LI	83	168	29.4	41	100/60	0.2	LSCS	3.8
SHANTHI	25	G3A2	84	154	35.4	40	110/60	0.3	LSCS	3.5
SANDHIYA	26	PRIMI	85	143	41.6	37	100/80	0.1	LSCS	3.1
INDRA	27	PRIMI	54	145	25.7	38	120/76	0.2	NVD	3
LATHA	24	G2A1	47	149	21.2	40	110/60	0.1	NVD	2.9
AKILA	27	G3P2L2	56	140	28.6	38	120/68	0.2	LSCS	2.7
SANGETA	27	PRIMI	59	135	32.4	37	120/60	0.1	LSCS	2.9
MITHRA	28	G2A1	51	140	26	38	110/68	0.1	LSCS	3
AFREEN BEGAM	23	PRIMI	52	167	18.6	39	110/70	0.3	NVD	3.2
ASIFA	21	G4P3L2	67	150	29.8	40	120/60	0.2	NVD	2.9
SARANYA	20	G2A1	70	150	31.1	41	120/80	0.1	NVD	3
PREETHI	20	PRIMI	78	154	32.9	40	100/68	0.1	NVD	3.2
SAVITHRI	19	G2P1L1	82	153	35	39	100/62	0.1	NVD	2.5
NASREEN	28	PRIMI	90	152	39	38	100/68	0.2	LSCS	2.7
BHARATHI	27	G2A1	91	158	36.5	39	110/68	0.3	LSCS	3.2
SELVI	28	PRIMI	88	167	31.6	39	110/68	0.1	NVD	3
BHAVANI	22	G2P1L1	92	153	39.3	40	100/68	0.2	LSCS	3
CHITHRA	21	G3A2	67	152	29	40	100/70	0.1	NVD	3.2
DEVI	27	G2P1L1	65	158	26	39	100/60	0.1	LSCS	2.7

CHINNATHAI	29	PRIMI	62	156	25.5	39	100/64	0.1	LSCS	3
FARTHIMA	20	G3A2	65	158	26	38	100/70	0.2	NVD	2.4
RUBINI	28	PRIMI	64	160	25	40	110/70	0.2	NVD	2.6

	SYSTOLIC FUNCTION						DIASTOLIC FUNCTION				AO cm	LA cm
	IVSs	**IVSd**	**LVPWs**	**LVPWd**	**EF**	**FS**	**E msec**	**A msec**	**E/A RATIO**	**IVRT**		
KAVITHA	1	0.82	1.4	1	67	34	64	47	1.36	80	3.1	3.1
SHANMATHY	1.5	0.84	1.3	1.08	68	30	88	56	1.57	60	3	3.2
AROGYANITHYA	0.8	0.8	1.3	1.03	70	36	90	54	1.6	90	2.6	2.8
PAVITHRA	0.8	0.8	1.2	0.92	76	30	88	46	1.9	70	2.9	3
MEENA	1.5	1.5	1.7	1	78	32	94	49	1.59	80	3	3.2
JOTHI	1.2	1.2	1.5	1	80	33	99	61	1.62	80	2.9	3.3
AISHWARYA	0.9	0.9	1.4	0.98	68	28	98	60	1.63	70	3	3.2
MEENA	1	1	1.3	1.02	72	30	84	43	1.9	76	2.8	3.4
SUGANYA	1	1	1.6	1	74	34	86	50	1.7	80	3.1	3.2
HAJEERA	1.3	1.3	1.2	0.87	80	30	89	48	1.85	68	2.7	3
SHOBANA	1.4	0.72	1.4	0.9	76	30	82	56	1.46	75	2.9	3.1
MEHRUN	1.1	0.67	1.5	0.7	74	36	94	54	1.7	74	2.7	2.9
ANJALI	1.2	0.74	1.6	0.9	78	34	94	60	1.65	80	2.4	2.8
SATHYA	1	0.82	1.2	1	82	37	84	43	1.9	75	2.64	2.8
RAHMAD NISHA	1.3	1.2	1.1	0.9	68	31	76	90	0.84	80	3.2	3.6
ILAVARASI	1.7	1.2	1.6	1.1	75	34	50	60	0.83	90	3	2.9
AISHA BANU	1.9	1.4	1.5	1	70	34	96	72	1.3	96	2.8	3.4
GOMATHY	1.4	1.2	1.9	0.9	69	32	70	96	0.72	108	3.1	3.1
DHIVYA RANI	1.2	1.2	1.4	1	76	35	88	46	1.9	70	2.9	3
SHANTHI	1.4	1.36	1.3	1.7	70	34	76	92	0.82	98	2.9	3.3
SANDHIYA	1.3	0.78	1.6	0.9	86	36	50	85	0.58	116	3.1	3.4
INDRA	1.5	0.64	1.4	1.13	85	29	90	60	1.3	90	3	3.1
LATHA	1.2	0.6	1.3	0.8	73	26	88	56	1.5	60	3	3.3
AKILA	1	0.93	1.01	1.1	72	34	86	46	1.9	74	2.9	3
SANGETA	1	0.87	1.1	1.06	67	34	78	56	1.3	75	2.9	3.3
MITHRA	1.3	0.72	1.2	1.1	68	29	70	96	1.51	130	2.9	3
AFREEN BEGAM	1.1	1.6	1.06	0.96	76	28	60	50	1.2	82	2.7	3.2
ASIFA	1.1	0.77	1.1	1	76	31	90	62	1.4	90	3	3.1
SARANYA	1.2	0.92	1.16	0.92	85	38	120	80	1.5	100	3	3.2
PREETHI	1.1	0.9	1	1.04	70	38	90	62	1.4	90	2.8	2.9
SAVITHRI	1.1	0.7	1.2	1	49	24	64	47	1.3	80	2.9	3.2
NASREEN	1	0.67	1.36	0.98	76	32	92	55	1.6	70	2.9	2.8

BHARATHI	1	0.87	1.1	1.06	67	34	78	56	1.3	75	2.9	3.3
SELVI	1.4	0.78	1.04	1	70	30	78	56	1.3	80	3	3.1
BHAVANI	1.2	0.74	1.12	0.87	72	30	120	90	1.3	86	2.8	3
CHITHRA	1.2	0.8	1.2	1.02	74	37	80	50	1.6	80	2.7	2.8
DEVI	1.1	0.8	1.4	0.9	77	36	64	47	1.36	90	3	3.1
CHINNATHAI	1	0.77	1.5	1	88	34	98	60	1.6	86	3	3.2
FARTHIMA	1.1	0.93	1.2	1	84	40	88	46	1.9	80	2.9	2.9
RUBINI	1.4	1.2	1.9	0.9	69	32	70	96	0.72	108	3.1	3.2

ETHICAL COMMITTEE APPROVAL FORM

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI 600 003

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301
Fax: 011 25363970

CERTIFICATE OF APPROVAL

To
Dr.K.M.Kunguma Sangeta M.B.B.S
Post Graduate in M.S. Obstetrics and Gynecology,
Institute of Obstetrics and Gynecology,
Madras Medical College, Chennai

Dear ,

The Institutional Ethics Committee has considered your request and approved your study titled **"LEFT VENTRICLE DYSFUNCTION IN PREECLAMPTIC PATIENTS " NO.15092016 .**

The following members of Ethics Committee were present in the meeting hold on **06.09.2016** conducted at Madras Medical College, Chennai 3

1. Prof. C. Rajendran, MD.	Chairperson
2. Prof. Dr. M.K. Muralidharan, M.S, M.Ch., MMC ,Ch-3	Deputy Chairperson
3. Prof. Sudha Seshayyan, MD., Vice Principal, MMC.Ch- 3.	Member Secretary
4. Prof. B.Vasanthi,MD.,Prof of Pharmacology, MMC,	Member
5. Prof. P.Raghumani.MS., Professor of Surgery, Inst. of surgery	Member
6. Prof. R.Padmavathy,MD., Professor, Inst.of Pathology, MMC,Ch	Member
7. Tmt.J.Rajalakshmi, Junior Administrative Officer,MMC,Ch	Layperson
8. Thiru.S.Govindasamy., B.A.B.L., High Court, Chennai-1	Lawyer
9. Tmt.ArnoldSaulina, MA., MSW.,	Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

23/9/16

Member Secretary - Ethics Committee

INFORMATION TO PARTICIPANTS

Title:LEFT VENTRICULAR DYSFUNCTION IN PREECLAMPTIC PATIENTS

Principal

Investigator : Dr.K.M.KUNGUMA SANGETA

Name of

Participant :

Institute of obstetrics and gynaecology,

Site : Egmore, Chennai.

You are invited to take part in this study. The information in this document is meant to help you decide whether or not to take part. Please feel free to ask if you have any queries or concerns.

What is the purpose of research?

To study the cardiac function in preeclamptic patients by transthoracic echocardiography and compare these features with normal pregnant patients, belonging to third trimester.

We have obtained permission from the Institutional Ethics Committee.

The study design

All participating pregnant women will undergo transthoracic echocardiography in third trimester

Study Procedures

The study involves evaluation of echocardiography in preeclamptic patients and normal patients in third trimester of pregnancy. You will subsequently be managed according to the hospital protocol. Your treatment protocol not changed. , Mode of delivery , labour outcome and baby weight also will be recorded.

Possible benefits to other people

The results of the research may provide benefits to the patients regarding their cardiac status and management of their problems and/or therapeutic benefit to future patients.

Confidentiality of the information obtained from you

You have the right to confidentiality regarding the privacy of your medical information (personal details, results of physical examinations, investigations, and your medical history). By signing this document, you will be allowing the research team investigators, other study personnel, sponsors, Institutional Ethics Committee and any person or agency required by law like the Drug Controller General of India to view your data, if required.

The information from this study, if published in scientific journals or presented at scientific meetings, will not reveal your identity.

How will your decision to not participate in the study affect you?

Your decision not to participate in this research study will not affect your medical care or your relationship with the investigator or the institution. You will be taken care of and you will not loose any benefits to which you are entitled.

Can you decide to stop participating in the study once you start?

The participation in this research is purely voluntary and you have the right to withdraw from this study at any time during the course of the study without giving any reasons. However, it is advisable that you talk to the research team prior to stopping the treatment/discontinuing of procedures etc.

Signature of Investigator Signature of Participant

Date Date

INFORMED CONSENT FORM

Title: .Left ventricular dysfunction in preeclamptic patients

Name of the Investigator: Dr..K.M.KUNGUMA SANGETA

Name of the Participant:

Name of the Institution: Institute of obstetrics and gynaecology, MMC, Chennai

I _____ have read the information in this form (or it has been read to me). I was free to ask any questions and they have been answered. I am over 18 years of age and, exercising my free power of choice, hereby give my consent to be included as a participant in this study.

1. I have read and understood this consent form and the information provided to me.
2. I have had the consent document explained to me.
3. I have been explained about the nature of the study.
4. I have been explained about my rights and responsibilities by the investigator.

5. I have informed the investigator of all the treatments I am taking or have taken in the past months/years
6. including any native (alternative) treatments.
7. I have been advised about the risks associated with my participation in the study.*
8. I agree to cooperate with the investigator and I will inform him /her immediately if I suffer unusual symptoms. *
9. I have not participated in any research study within the past.*
10. I am aware of the fact that I can opt out of the study at any time without having to give any reasoned this will not affect my future treatment in this hospital.*
11. I am also aware that the investigators may terminate my participation in the study at any time, for any reason, without my consent.
12. I hereby give permission to the investigators to release the information obtained from me as result of participation in this study to the sponsors, regulatory authorities, Govt. agencies, and IEC if required.
13. Iunderstand that my identity will be kept confidential if my data are publicly presented.
14. I have had my questions answered to my satisfaction.
15. I consent voluntarily to participate in the research/study.

I am aware that if I have any question during this study, I should contact the investigator. By signing this consent form, I attest that the information given in this document has been clearly explained to me and understood by me. I will be given a copy of this consent document.

For adult participants

1. Name and signature / thumb impression of the participant (or legal representative if participantincompetent)

Name _____ Signature_____

Date_____

2. Name and Signature of impartial witness (required for illiterate patients): Name _____

   Signature_____ Date_____

Address and contact number of the impartial witness:

3. Name and Signature of the investigator or his representative obtaining consent: Name _____

   Signature_____ Date_____

PLAGIARISM CERTIFICATE

This is to certify that this dissertation work title "**LEFT VENTRICULAR DYSFUNCTION IN PREECLAMPTIC PATIENTS"** of the candidate Dr.K.M.Kunguma Sangeta with registration number 221516008 for the award of M.D in the branch of Obstetrics and Gynecology. I personally verified the urkund.om website for the purpose of plagiarism check. I found that the uploaded thesis file contains from introducation to conclusion pages and result shows 7 percentage of plagiarism in the dissertation.

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